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THESIS

ROLE OF SOCIAL NETWORKS IN RESILIENCE OF NAVAL RECRUITS: A QUANTITATIVE ANALYSIS

by

Andrea M. Watling

June 2016

Thesis Advisor: Edward H. Powley
Co-Advisor: Frank J. Barrett

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ROLE OF SOCIAL NETWORKS IN RESILIENCE OF NAVAL RECRUITS: A QUANTITATIVE ANALYSIS

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
CD-RISC	Connor-Davidson Resilience Scale
RCPO	Recruit chief petty officer
RLPO	Recruit leading petty officer
RMAA	Recruit master-at-arms
RYN	Recruit Yeoman
UCINET	Social Network Software created by University of California, Irvine

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I. INTRODUCTION

A. BACKGROUND INFORMATION ON NAVAL RECRUITS IN TRAINING

The goal of the Navy's military training is to provide the fleet with sailors equipped with basic knowledge and skills to prepare them for challenges on a shore- or sea-duty command. During this time, new recruits go through a training experience that is like no other: they encounter situations that will challenge their mental and physical abilities, break down their spirits, and develop their minds and bodies for future arduous duties. The Navy's Recruit Training Command (RTC) facilitates basic recruit training, or "boot camp," to ensure the experiences that recruits encounter mimic some of the physical, mental, and emotional difficulties recruits will face in the fleet. The changes new recruits experience and their ability to bounce back from these difficulties are the focus of this study. Accurate measurements of recruits' resilience on individual and division levels could help facilitators at RTC ensure the training successfully transforms recruits from civilians into Sailors, ready for what the future holds.

1. A Recruit's Life: Boot Camp and Beyond

The first week of basic training consists of medical, dental, and administration screenings, also known as processing days or P-Days. In this part of the training process, recruits are probed and evaluated to ensure they are physically and mentally fit to undergo training. This process makes some recruits feel uncomfortable, but it provides an important indoctrination into the reality that their lives are under scrutiny and their personal space is no longer private. Early on, recruits establish daily routines, and realize that working together with fellow recruits as a team or division is necessary to get through training. The recruits learn various commands and training requirements that they will practice day-in and day-out until they graduate basic training. The division's training environment mirrors a U.S. Navy ship to enhance the training experience. Once a recruit is assigned to a division, he or she will live in a barracks, which recruits refer to as their "ship." This ship will be their home during the next seven weeks of training. Each ship houses approximately 1,300 recruits, and contains multiple sleeping quarters called

berthing compartments, a cafeteria called a galley, and multiple classrooms for academic learning. Each berthing compartment houses up to 88 recruits, which makes up one division (Recruit Training Command, 2015). Divisions can either be male/female integrated or all-male. The male/female integrated divisions are housed in separate compartments or berthing areas, but come together for training to learn and work as a team.

2. Recruits in Training

At the conclusion of the recruits' processing days, they are trained to stand security watches and rover patrol, which means to inspect and properly secure the ship. Regular physical training also begins to increase strength and improve the stamina of recruits. Teamwork, self-discipline, and constant attention to detail are ingrained in each individual during training. Recruits spend time in the classroom to receive a basic orientation and knowledge of naval history, policies, and procedures. Recruits are also trained technically to provide hands-on practice out of the classroom, in the areas of basic seamanship, water survival skills, shipboard damage control, firefighting, weapons training, and anti-terrorism/force protection. These trainings help recruits gain the basic knowledge necessary to function in the fleet (Recruit Training Command, 2015).

3. From Recruits to Sailors

Once recruits complete nearly eight weeks of academic and physical training, a final phase called "battle stations" tests individual and division readiness prior to graduation (Recruit Training Command, 2015). This final event marks the end of the recruit phase of training. Once recruits pass battle stations, they earn the title of United States Sailors. A formal military graduation, also known as Pass in Review, is the ceremony that all friends and families attend to commemorate this stage of their sailors' life (Recruit Training Command, 2015). After the ceremony, the newly branded sailors push forward to their next duty station as the newest members of the fleet.

Indeed, the Navy's boot camp provides many challenges and changes in a person's life. Thus, Navy basic training provides a good starting point to measure recruit resilience and ability to cope with challenges and changes during this period. It is also a

good starting point to assess how the division collectively perceives resilience levels as a group. In this study, I focus on the positive energy of recruits as evaluated by their peers and compared those energy levels with self-reported resilience levels. I then look at the connections that formed the social network using the assessed energy levels of recruits to evaluate patterns and trends. Doing this could help the Navy understand the underlying factors that affect a recruit's success during training.

B. PURPOSE

The data collected during this research has a high likelihood of helping the Navy understand and analyze the ability of Navy recruits to bounce back from adversity by developing positive social networks that build resilience. This thesis builds on previous and current theses from the Naval Postgraduate School (NPS), including studies by Ian Barr and Chris Burt (2015) as well as Caroline Brown and Maribel Challburg (2016), on resilience of Navy recruits. This thesis emphasizes the role and functions of positive energy and social networks.

Borgatti, Everett, and Johnson (2013) define a social network as a social structure made up of a group of social actors or individuals within an organization with a set of hierarchical relationships between one another. The social network often describes relationships other than the formal lines of reporting and command and control. The individual's position within the network, or *status,* appears to affect the success or failure of that individual within the social system (Borgatti et al., 2013, pp. 1–2). Research in the field of social networks examines how a position within a network might contribute to an individual's performance and that of his or her peers. A few studies have identified that positive energy of individuals within a network correlates with how other individuals in the same network bounce back from hardship. This thesis examines these trends during the training process at the U.S. Navy's Recruit Training Command in Great Lakes, Illinois.

The objective of this study is to identify trends in recruit interaction by focusing on the positive energy of the individuals. Borgatti et al. (2013) looked at how patterns of relationships align with positivity levels. This study follows their lead. I examine positive

energy networks of U.S. Naval recruits to measure patterns of resilience. To fulfill the objective of this study, I performed quantitative analysis using surveys and interview data to determine the effects of positive energy on recruit resilience within the social networks (see Brown & Challburg, 2016). Using UCINET's Netdraw application I show the social networks associated with the control and treatment groups. Visualization software was used to compare divisions that had higher positive energy levels to their reported resilience. In identifying the social networks of recruits within a division, I was able analyze the structure of each division as well as the patterns observed in network structures.

C. RESEARCH QUESTIONS

In this thesis, I address several questions as they relate to the social network of Navy recruits at RTC:

1. How does positive energy of recruits within the social network differ between the control groups and the treatment groups?
2. How do we explain the differences between the positive energy levels and the degree of resilience levels reported by each division?
3. What is the relationship between specific survey measures (individual and organizational resilience, cohesion, and procedural justice) and network characteristics (degree of centrality, density, cohesion and distance)?

D. THESIS LAYOUT

Chapter II explores the various studies in the field of positive energy in organizations, resilience, and social networks. Chapter III describes the methodology and data collected from Navy Recruit Training Command in Chicago, Illinois. Chapter IV describes the implementation used in this study. Chapter V describes the network results found in this study. The final chapter of this thesis presents the conclusions for this thesis and describes possible future studies that can extend this visualization utilizing the data collected.

II. LITERATURE REVIEW

A. INTRODUCTION

In this section, I describe the definition and methods used in existing literature to provide a foundation for resilience and positive energy as well as for relationships in the workplace. Previous studies by Lopes (2010), Burt and Barr (2015), as well as Brown and Challburg (2016) provide a solid framework on resilience, which will be referenced throughout this thesis. There are minor differences between the definition of resilience at the individual and organizational levels, but the common theme across the board on both levels is that resilience is viewed as the ability to overcome and bounce back from extenuating circumstances or adversity (Connor & Davidson, 2003; Coutu, 2002; Luther & Cicchetti, 2000; Rutter, 2008; Sutcliffe & Vogus, 2003). The common theme for positive energy and positive relationships is that they both correlate with success and increased productivity in the workplace.

This literature review focuses mainly on the connection between positivity levels and an individual's success in the workplace, the factors that contribute to resilience, and the means for measuring resilience at the individual and organizational levels. Baker, Cross, and Wooten (2003) utilized a similar methodology to this thesis to show how relationships with positive connections generate increased productivity in the workplace. Similarly, Cross, Wayne, and Parker (2003), by using mathematical analysis to map individuals' positivity levels, quantified how a person's position within a social network is linked to performance and learning. Casciaro and Lobo (2008) extended the concept of linking positivity levels in a social network by measuring an individual's willingness to help another person in the work place given one's feelings toward that co-worker. All of these studies in combination with Connor and Davidson's (2003) self-reporting rating measures provide the foundation for my thesis.

B. INDIVIDUAL AND ORGANIZATIONAL RESILIENCE

Connor and Davidson (2003) defined resilience as an individual's ability to cope under stressful situations and be able to bounce back from those hardships (p. 76). Over

the last two decades, other researchers have defined resilience as a characteristic that varies over time, context, upbringing, culture, age, and gender. Many researchers have viewed this characteristic as a stress-coping ability that depends on internal and external factors or stressors (Connor & Davidson, 2003, p. 77). Sutcliffe and Vogus (2003) referred to resilience not only as an individual's or organization's capacity to maintain positive adjustment in difficult circumstances, but also a dynamic that emerges and changes over time. In the same vein, Luthar and Cicchetti (2000) defined resilience as a dynamic process rather than a specific trait. They proposed that resilience is a two-dimensional construct that suggests openness to adversity and the adaptation of positive adjustments despite significant adversity or trauma (p. 858).

At the individual level, Rutter (2008) defined resilience not as a general characteristic but rather an interactive concept that varies based on individual responses or reactions to overcome adverse situations—and that can be learned by an average individual. Another definition of individual resilience, in line with Janoff-Bulman (1985, 1992) and Tugade and Federickson (2004), is described by Powley (2012) as pertaining to "how individuals overcome trials and learn from adversity" (p. 44).

Meyer (1982) defined organizational resilience, much like the concept of individual resilience, as the "ability to absorb a discrete environmental jolt and restore prior order." (p. 520). Wildavsky (1988) viewed organizational resilience as the "capacity to cope with unanticipated dangers after they have become manifest, [and] learning to bounce back." (p. 77). A more recent description of organizational resilience by Sutcliffe and Vogus (2003) has built on the aforementioned definitions of the 1980s: the "ability to absorb strain and preserve (or improve) functioning despite the presence of adversity" (p. 96). In addition, Sutcliffe and Vogus (2003) have pointed out that

> organizational resilience is anchored in organizational processes aimed at enhancing an organization's overall competence and growth (especially the ability to learn and to learn from mistakes), and restoring efficacy through enhancing the ability to quickly process feedback and flexibly rearrange or transfer knowledge and resources to deal with situations as they arise. (p. 104)

Coutu (2002) suggested that in order to evaluate the nature of resilience, it is necessary to first identify the positive behaviors that enable groups and organizations to learn, adjust, develop, and thrive from challenges. Studies over the past decade have suggested that, in the long run, organizations must face trade-offs between increasing productivity and building competent employees. Sutcliffe and Vogus (2003) have interpreted this ability to manage positive adaptation during periods of uncertainty as evidence of resilience (p. 104).

Through learning, competence, and continued improvement, resilience can be adapted and built over time using interventions. Interventions that focus on individual and group resilience using positive affirmation, feedback from a recruit's division commander and guided discussion among the division, as well as appreciative guided conversations will be discussed in later chapters. These interventions were designed and implemented in a resilience study by Brown and Challburg (2016) to expand prior studies and research in the field of resilience.

C. POSITIVE ENERGY NETWORKS

There is a significant correlation between an individual's general energy and his or her effect on an organization's success or failure. Casciaro and Lobo (2008) analyzed the role of positive and negative feelings toward co-workers in task-related networks (p. 655). They explored how individuals reacted to one another and how they worked together to complete tasks at work. Their study showed that the influential factor was emotion rather than obligation. Casciaro and Lobo (2008) found that when someone is "unliked"—in other words, others feel negatively toward that person—co-workers are less likely to complete a task for that individual. On the other hand, when someone is "liked"—in other words, others feel positively toward that person—co-workers are more likely to complete a task for that individual (p. 660). Casciaro and Lobo's findings suggest that having positive feelings toward another increases the likelihood that one will help with tasks at work and that maintaining a positive interpersonal affect increases competence and facilitates success.

Measuring how much energy is generated by different people and determining how that energy affects other individuals within the organization is crucial for network analysis. Utilizing mathematical methods, Cross, Wayne, and Parker (2003) devised a way to determine how relationships within a social network affect the energy of an individual or a group of individuals within an organization. Their analytic approach linked a person's position within a social network to individual energy levels. They used individual positions to create an "invisible map" of the energy levels to show the web of connections in the social network. Cross et al. mapped the social networks and determined which individuals were "energizers" and which were "de-energizers." The authors described an energizer as "someone who can spark progress on projects or within groups" (p. 51). Those individuals considered energizers were also associated with higher productivity and increased learning within the organization. Their study reveals that energy has a significant and probable connection to individual performance and productivity (pp. 51–53).

Borgatti et al. (2013) illustrated how networks make up the relationships of individuals or actors in a whole system or organization. These actors, also known as *nodes*, represent individuals in a network. Each node comprises individual characteristics, or *attributes*. These attributes, such as gender, age, and education level, distinguish nodes from each other. Borgatti et al. (2013) called the network relationships between nodes "ties" or "links" (pp. 1–2). These ties or links create pathways that connect directly or indirectly through common nodes, which in turn create a web also known as a social network. The social network concept conceived by Borgatti et al. has allowed other researchers to draw invisible maps using individual connections (p. 2). Follow-on studies have used multivariate or correlative methods to depict and measure the individual connections as a function of other variables in a social network.

Borgatti et al. (2013) adapted Freeman's (1979) approach as a standard to measure a node's centrality (p. 160). The authors described the measure of *centrality* as both the property of a node's position and its structural significance within a network (Borgatti et al., 2013, p. 164). In other words, nodes with more ties to other nodes in the network may be in advantageous positions because they have access to resources or may

be able to satisfy needs of other nodes in the network. Oftentimes, the centrality of a node corresponds with people of influence or prominence. With the help of UCINET, one calculates the degree of a node's centrality using Freeman's (1979) approach to measure the node's potential for influence or prominence in terms of positivity levels. The theorized process of network analysis of Borgatti et al. allows for the measurement of each recruit's centrality within the network using his or her positive energy scores to compare with self-reported resilience scores.

An empirical study by Baker et al. (2003) focused on "energizing relationships" within network analyses of seven different organizations in which social network surveys and interviews were used to gather data on how an individual's perceived energy affected relationships within the organization (p. 331). Their research combined aspects of positive organizational scholarship and organizational network analysis to create the foundation for positive organizational network analysis. It also identified how an individual's positive ties contribute to the social structure and performance in an organizational setting. The Baker et al. study is relevant to this thesis because its data collection method and the utilization of a five-point Likert scale to determine the energy levels of individuals are similar to the methodology used in this study. Connecting network theories and statistical methodologies to study positive energy in organizations enabled the researchers to quantify the effects of positive relationships within an organization. Their study found that those who are perceived to generate positive energy by their co-workers develop positive relationships. Those perceived as having positive energy are also better performers. Baker et al. have suggested that positively energizing relationships generate energy that can be productive and empowering in the workplace (p. 340).

One way to quantify positive energy relationships in a network is by determining the network's characteristics. According to Borgatti et al. (2013), *cohesion* is the main characteristic of a whole network. The level of cohesion within a network depends on what they termed "knittedness." A network's knittedness describes how interconnected the nodes are with one another (p. 150). In this thesis, the term cohesion does not necessarily correspond with the sociological cohesion of the network. In other words,

cohesion is not the bond that holds a group together through social values and norms. In social networks, the simplest way to measure cohesion is by counting the number of ties in the network, also known as density. Density is expressed as a proportion of the number of possible ties in the network (Borgatti et al., 2013, p. 150). In essence, density is the result of dividing the total number of all values, in this case the positive energy values assigned to each recruit, by the number of possible ties in the network. With a measurement of positivity levels, the cohesion of the networks consists of "who energizes whom" ties, and the network density represents the overall level of knittedness within the recruit training divisions.

Another way of characterizing whole networks is by measuring the extent to which a single node dominates the network. According to Borgatti et al. (2013), we can interpret the degree of *network centrality* by evaluating the structural significance of the network ties (p. 165). In this thesis, I calculate the degree of a network's centrality to provide a different perspective on the recruit training division's measure of cohesion. I further illustrate and compare the centrality of each division against its self-reported resilience scores. This allows me to compare the rankings of the recruit training divisions at T2 and T4 based on their network density and centrality.

> *Hypothesis 1: Divisions with resilience interventions will likely have stronger centrality and denser positive energy networks compared to those divisions that did not receive interventions.*

D. COHESION AND PROCEDURAL JUSTICE

Colquitt (2001) referred to organizational justice as the reason why individuals work for organizations and the degree to which they perceive decision making in the workplace as just or fair (p. 1). Greenberg (1990b) defined organizational justice as something that can be "grown around attempts to describe and explain the role of fairness as a consideration in the workplace" (p. 400). Colquitt (2001) explained the "impact of justice on effective organizational functioning" using Greenberg's rubric (p. 425). Colquitt's (2001) study suggested that organizational justice could be measured using instrumental and relational models of justice. He suggested that analysts should separate

the effects of the decision-making process from the effects of the decision maker's authority and substitute system-originating justice for fair treatment of a leader in an organization (p. 16).

On the other hand, cohesion in the realm of organizational research has focused mainly on identifying factors and processes that result in increased group performance. The focus has been primarily on the social and motivational forces attributed to members of the group (Beal, Cohen, Burke, & McLendon, 2003, p. 1). Beal et al. (2003) examined issues pertaining to group cohesion and performance by investigating the role of components of cohesion using more modern meta-analyses. Their study hypothesized that the cohesion–performance relationship will strengthen if performance is measured as a behavior rather than an outcome. Beal et al. (2003) also hypothesized that measures of performance efficiency have a stronger correlation with cohesion than do measures of performance effectiveness. Their study revealed that groups are more likely to perform better when the goal of the organization corresponds with efficiency; thus, cohesive groups gain the particular advantage of performing better (p. 10).

> *Hypothesis 2: Divisions with resilience interventions will demonstrate higher cohesion and sense greater procedural justice compared to those divisions without interventions.*

E. CONCLUSION

There is a common theme among scholars that provides a foundation for understanding and defining resilience. Both at the individual and organizational levels, resilience is seen as the ability to cope under stressful situations, bounce back, and recover from adversity (Connor & Davidson, 2003; Coutu, 2002; Luther & Cicchetti, 2000; Rutter, 2008; Sutcliffe & Vogus, 2003). Studies from Baker et al. (2003), Cross et al. (2003), as well as Casciaro and Lobo (2008) solidify the concept of linking positivity levels to increased productivity and success in the work place. By combining the theories of positivity levels and resilience measures, I utilize the methodology of Borgatti et al. in Chapters III and IV to depict the social network of individuals within training divisions. I use their approach to quantify cohesion within a network by measuring density and

centrality. Their methods also allow me to determine whether the nodes with structural significance in the network coincide with recruits in leadership positions within their respective divisions.

III. METHODOLOGY

A. INTRODUCTION

In this section, I describe the methods and sample used to determine resilience, cohesion, and procedural justice measures, as well as positivity levels. A few studies developed validation methods to measure resilience but have neither gained foothold nor wide acceptance in this field of research. The Connor-Davidson Resilience Scale (CD-RISC) was developed to help quantify measures of resilience through a brief and self-reported rating scale (Connor & Davidson, 2003, pp. 77–78). Aside from being utilized in clinical studies, researchers also apply the CD-RISC scale in studies as a reference to assess values for resilience. The CD-RISC was applied to assess individual values for resilience while organizational resilience measures were assessed using methods from previous study by Lopes (2010), Burt and Barr (2015), as well as Brown and Challburg (2016).

B. SAMPLE

There were a total of four time periods, T1, T2, T3, and T4, during which the surveys were administered for this study. I focus on time periods T2 and T4, which aligned approximately with weeks four and seven of recruit training, during which questionnaires and interventions on social networks were administered. The data in this study comprises 628 surveys during the second time period (T2) and 669 surveys during the fourth time period (T4), totaling 1,297 surveys, from naval recruits at the Recruit Training Command in Great Lakes, IL. A total of eight divisions of recruits, with a range of 67–97 recruits per division, were included in this study. Two divisions were control groups, and six divisions were treatment groups that received training and interventions. Division 1 (D1) and Division 2 (D2) were the two control groups that received no interventions. Division 3 (D3) and Division 4 (D4) received the first intervention, which focused on the positive identity statement of the study. Division 5 (D5) and Division 6 (D6) received the second intervention, which was composed of small group debriefs. Last, Division 7 (D7) and Division 8 (D8) were the two remaining divisions that received

an intervention, which concentrated on guided conversations. An outline of the divisions and interventions conducted during the surveys is shown in Table 1.

Table 1. Control and Treatment Groups

Divisions	Intervention	Description
D1 and D2	No Intervention	Control
D3 and D4	Intervention 1	Positive Identity Statement
D5 and D6	Intervention 2	Small Group Debrief with Positive Identity Statement
D7 and D8	Intervention 3	Appreciative Guided Conversation

Intervention 1 assisted recruits in developing their ability to build resilience as they encountered challenges and experiences through "positive self-talk." Recruits were given notecards to itemize and develop positive statements they could use in stressful and challenging situations. Intervention 2 focused on the recruit division commanders (RDCs) in fostering social resilience and social interventions. The RDCs encouraged recruits to review and analyze their performance during the line-handling lab, basic damage control, and firefighting events to encourage feedback and group performance as part of their after-action debriefs. Intervention 2 combined the positive identity statement of Intervention 1 with small group debrief interventions. Intervention 3 encouraged a space for semi-structured recruit dialogues by allowing recruits to have "guided conversations" to increase social and organizational resilience. The guided conversations included a brief on resilience and the power of positive relationships during which recruits were allowed to initiate dialogue with one another. This process encouraged recruits to develop their own positive personal statements as a way to build group cohesion. All aforementioned interventions were designed and implemented in this study. For further discussion on the interventions used in this study, please refer to Chandler Brown and Maribel Challburg's (2016) thesis on resilience of Navy recruits.

Participants from all divisions received identical surveys at specific points throughout their training. However, this study only looks at two time periods to measure

individual and unit resilience changes over time using positive energy scales. The ratings for the positive energy question were on a 3-point Likert scale, in which a *1* indicated a person as a weak source and a *3* indicated a person as a strong source of positive energy.

The data collected during this research was used to analyze each division's social network. I manually tracked the recruit responses to measure the positive energy levels provided in the survey responses. This study aims to help in understanding and analyzing the resilience of naval recruits as it correlates with their positive energy levels. This thesis also creates a foundation for other future studies of naval recruits' social networks. Overall, this thesis looks at the connection between the recruits' resilience and positive energy levels. These patterns of social networks might help identify and improve resilience.

This study focuses on the following question to quantify recruit responses to rate their peer's positive energy levels as shown in Table 2 below.

Table 2. Positive Energy Question

"Think of those in your division who you consider to be a source of positive energy—people who energize you and who you look forward to seeing and interacting with on a regular basis. Of those you checked in Column A, to what extent did they energize you?"
1 = to a little extent
2 = to some extent
3 = to a great extent

This question provides quantifiable data to measure the positive energy (Borgatti, et al., 2013) of individuals as it relates to their social network within the division. Future researchers in this field of study can expand on this thesis once the data is entered in electronic format and ready for analysis.

During both time periods used for this study, respondents rated all the recruits in the division, whether those recruits were still part of the division or not. While some recruits may not have completed the final phase of the training process, others may not have graduated with the same division they started training. This means that some recruits were not able to provide survey responses during both time periods (T2 and T4) of the study. In order to analyze the data in UCINET, missing responses from recruits that received ratings were labeled *missing* to "square off" the data. The data with labeled missing responses are recorded with the following number of missing data points: 108 out of 628 responses, which is 17 percent, at T2 and 141 out of 669 responses, which is 21 percent, at T4. I also had to create two data attributes for each division to match the composition of recruits at the time the surveys were given. I removed all personally identifiable information (PII) from this thesis and I created new division numbers for each of the divisions, and each recruit was given identification numbers to create anonymity.

C. RESILIENCE MEASURES

During the training phase, recruits build resilience as they undergo stressful conditions, face challenges, and develop belongingness to the Navy as Sailors. The interventions used in this study were intended to facilitate improved resilience among recruits. The survey questions asked recruits to self-report their resilience measures at the individual and organizational levels. The questions that were asked to measure the recruit's resilience, used five of the 25 self-rated Connor and Davidson Resilience Scale (CD-RISC) questions to assess values. The recruits were also asked questions to measure their cognitive bias through positive framing by indicating on a self-rated scale their ability to react to one or more circumstances in a positive way. At the same time, they were asked to assess the resilience of their division as a whole using self-reported ratings (Lopes, 2010; Burt & Barr, 2015; Brown & Challburg, 2016). The recruits were also asked to assess the division's cohesion as well as the fairness of the division's procedures used to make decisions and accomplish tasks.

Self-report measures for these variables were compared with individual network responses. The individual results help me determine whether a node with structural significance within the network holds a leadership position in the division. This allows me to identify whether there are trends at the individual level that link positivity levels to resilience and leadership. The data also allow me to explore the self-reported measures of the divisions and to compare them with network measurements from UCINET.

D. CONTROL VARIABLES

The survey also contains demographic data that includes the gender, rate, age, Armed Forces Qualification Test (AFQT) score, verbal expression (VE) score from the AFQT, and years of education for each recruit. These characteristics are also known as attributes. The composition of each division's social network is better understood by identifying certain attributes. This study then evaluates the visualization of the social networks existing between recruits and the divisions during the two time periods. This research not only uses the control group to serve as a baseline for the treatment group but also reveals how a division's social network and resilience naturally change over time and throughout the training process.

E. TRANSPOSING THE DATA

In order to illustrate networks in a mathematical way, an adjacency matrix was constructed for both the survey and attribute data. Prior to constructing an adjacency matrix, the data must first be transposed. Transposing the data is simply, to interchange its rows with its columns (Borgatti et al., 2013, p. 70). An adjacency matrix shows each element in a row and a column represented by a node. An entry in row *i* and an entry in column *j* represents a tie from *i* to *j*. By convention, the direction of the matrix goes from rows to columns. When surveys are used to create adjacency matrices, the rows typically correspond with the respondents, also known as egos, and the columns correspond with the people mentioned by the ego, also known as alters (Borgatti et al., 2013, p. 70). This process creates a two-dimensional data structure for the network analysis and helps maintain ties in the network data. In this study, the values reflected in the matrix are

values that indicate the level of extent to which a person in row *i* is energized by the person in column *j*. See Appendix A for the two-dimensional matrix.

In this study, each time period of the survey and attribute data were "squared off," which means all individuals in each column have a corresponding tie in each row. This process is also known as "symmetrizing." Symmetrizing refers to the process of creating a new dataset in which all ties have reciprocated values whether given during the survey or added thereafter to square off the data (Borgatti et al., 2013, p. 76). This process cleans the data for the analytical techniques of the social network analysis. Sometimes, there are unintended asymmetry in survey data because survey takers excluded the names of individuals mentioned them. The rule of thumb is that if either person mentioned the other, then we must consider it a tie. Borgatti et al. (2013) called this rule the "AND, or intersection rule" (p. 77). When respondents do not have corresponding ties, I added the missing correspondents in the rows of the data set and entered their values as "missing." Although this process could make the networks denser than its original state, this paper's very few missing additions should not greatly inflate the data. See Appendix A for the two-dimensional matrix with missing values.

F. CONVERTING ATTRIBUTES TO MATRICES

During the survey, each recruit was asked to provide demographic data that included his or her gender, rate, age, and years of education. These demographic or personality characteristics are also known as attributes. In order to properly transfer attribute data into UCINET, I squared off all rows corresponding to each respondent exactly as they appeared. These attributes were loaded in UCINET to identify the characteristics of central nodes within the networks. See Appendix A for the two-dimensional attribute matrix.

G. SURVEY RESPONSES

The number of total recruits in each division did not match the total number of respondents. The total response rates, which is the total number of respondents divided by the total number of recruits in each division at T2 and T4. During T2, Division 7 has an impressive response rate of 100 percent, while Division 1 has the lowest response rate

of 65 percent. During T4, Division 4 has the highest response rate of 96 percent, while Division 7 who had the highest response rate at T2 now has the lowest response rate of 85 percent. Overall, the tables show a response rate of 65 to 100 percent for all divisions at T2; while a higher response rate of 85 to 96 percent for all divisions at T4. The total response rates at T2 and T4 are shown in Table 3 and Table 4.

Table 3. Response rates at T2

Division	Total number of respondents	Total number of recruits	Response Rate
Control D1	57	88	65%
Control D2	80	93	86%
Intervention 1 D3	82	90	91%
Intervention 1 D4	88	92	96%
Intervention 2 D5	84	96	88%
Intervention 2 D6	83	89	93%
Intervention 3 D7	67	67	100%
Intervention 3 D8	84	91	92%

Table 4. Response rates at T4

Division	Total number of respondents	Total number of recruits	Response Rate
Control D1	83	91	91%
Control D2	83	97	86%
Intervention 1 D3	82	90	91%
Intervention 1 D4	88	92	96%
Intervention 2 D5	86	93	92%
Intervention 2 D6	83	90	92%
Intervention 3 D7	79	93	85%
Intervention 3 D8	85	91	93%

At T2, the average response rate was 89 percent while the average response rate at T4 was 91 percent. There is not a lot of difference in the average response rate between the two time periods; however, it can be observed that during both time periods, with the

exception of D7 at T2, the total number of respondents did not match the total number of recruits in the division. Various factors could explain the difference between these two numbers. It could be that recruits were not available during the time the surveys were taken due to illness, extra military duty, or other training requirements such as swimming qualifications.

IV. NETWORK RESULTS

A. MEASURES OF NETWORK CONNECTIONS

As discussed in Chapter II, a network's characteristic can be measured by looking at either its density or its level of centrality. Density depicts how the ties in the network are connected with each other. On the other hand, centrality measures the structural significance of a node within a network. By calculating both density and centrality of the network, I was able to compare the divisions to each other at time period two (T2) and at time period four (T4). Next, I compared the results of both measures against each division's self-reported resilience, positive framing, and cohesion scores to identify structural patterns within the network. Then, I ranked the divisions based on number of connections; a division ranked 1 had the strongest connection while the division ranked 8 had the weakest connection. Using the division rankings, I was also able to determine whether the divisions improved or worsened at T4.

1. Density

Borgatti et al. (2013) has explained that density can be interpreted as "the probability that a tie exists between any pair of randomly chosen nodes" (p. 150) yet simply depicts how the ties in the network are connected with each other. By measuring the density of the divisions, I was able to rank each division by assessing the number of ties at T2 and T4. Since I looked at valued data, I simply computed the average of all values, which was the computed average of the division's tie strength using UCINET. Next, I ranked the strongest and weakest divisions at T2 and T4 based on their density levels.

Overall, the division with the least improved density was Division 4, with a density of 0.388 at T2 that dropped to 0.101 at T4. On the other hand, the division with the most improved density was Division 6, with a density of 0.263 at T2 that increased to 0.384 at T4. Therefore, Division 4 is considered to have been the weakest division while Division 6 is considered to have been the strongest division in terms of density. Meanwhile, Division 5 reflected an increase in density from 0.265 at T2 to 0.370 at T4.

Interestingly, both divisions received interventions at T2. All density values for T2 and T4 are shown in Table 4.

Division 4, with the weakest density, received the positive identity statement intervention while Division 6, with the strongest density, received the small group debrief intervention combined with the positive identity statement intervention. Although Division 8 showed a slight decrease in density at T4, its density remained approximately the same throughout the training process, as depicted in Table 5 and in Figure 1.

Table 5. Density Rankings at T2 and T4

Division	T2	Overall Rank at T2	T4	Overall Rank at T4
Control D1	0.440	1	0.320	5
Control D2	0.268	6	0.085	8
Intervention 1 D3	0.433	2	0.390	1
Intervention 1 D4	0.388	3	0.101	7
Intervention 2 D5	0.265	7	0.037	3
Intervention 2 D6	0.263	8	0.384	2
Intervention 3 D7	0.302	4	0.327	4
Intervention 3 D8	0.274	5	0.267	6

Both Division 5 and Division 6, whose recruits received the small group debrief intervention combined with positive identity statement intervention, had the most improved divisions in terms of density compared to other divisions that also received an intervention. On the other hand, Division 3 and Division 4, whose recruits only received the positive identity statement intervention, did not improve their density from T2 to T4. Instead, their divisions' density actually decreased from T2 to T4. Surprisingly, Division 7 and Division 8, whose recruits received the appreciative guided conversation, experienced a very slight change in their density from T2 to T4. The control groups, Division 1 and Division 2, both performed very poorly from T2 to T4, which was expected from divisions that did not receive any intervention, as shown in Table 5 and in Figure 1.

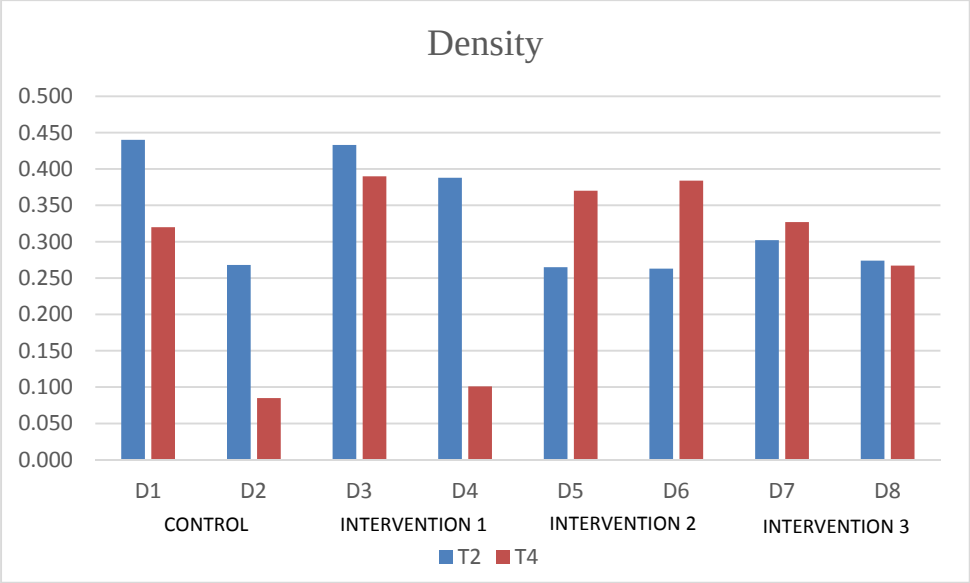

Figure 1. Density of Divisions at T2 and T4

2. Centrality

Another way to measure a network's characteristic is by looking at the node's centrality, or *position* within the network. The simplest way to measure centrality is by determining the node's *degree*, the number of ties a specific node has within the network (Borgatti et al., 2013, p. 165). Since UCINET was able to measure network centralization, I was also able to rank each division at T2 and T4 using this method. Just like the density rankings, the division ranked one had the highest measure while the division ranked eight had the lowest measure. Using the division rankings, I was again able to determine whether the divisions improved or worsened at T4. UCINET is able to measure the *in-degree centrality*, or the number of ties the node received, and *out-degree centrality*, the number of ties the node exchanged with other nodes. The nodes that receive many ties are nodes with high in-degree centrality values. These nodes are often distinguished as *prominent*, or to have high prestige, because many nodes seek to direct ties to them.

With the help of UCINET, I determined which individuals were able to exchange with many individuals at high out-degree centrality values. These recruits were often distinguished as *influential* nodes, or those able to make many other individuals mindful of their views. At the organizational level, the division ranked one had the highest

measure while the division ranked eight had the lowest measure. Using the rankings of the divisions, I was again able to determine whether the divisions improved or worsened at T4.

a. In-degree Centrality

Division 1, which received no intervention at T4, remained at the bottom half of the rankings, being ranked number five at T2 and T4. Division 2, which also received no intervention, remained at the very bottom of the rankings, from rank seven at T2 to rank eight at T4. Division 3 which received a positive identity statement intervention, which resulted in an increase in in-degree centrality from rank six at T2 to rank four at T4. Though Division 4 also received a positive identity statement intervention at T4, it dropped from rank three at T2 to rank seven at T4, making it the least improved division in terms of in-degree centrality. On the other hand, Division 5 which received a small group debrief intervention combined with positive identity statement intervention, increased its in-degree centrality from rank eight at T2 to rank six at T4. Division 6 which also received a small group debrief intervention combined with positive identity statement intervention, ranked two at T2 and T4. Division 7 which received appreciative guided conversation intervention, reflected the highest in-degree centrality in the network at T2 and T4. Division 8 also received a guided conversation intervention but showed a decrease in in-degree centrality, from rank four at T2 to rank six at T4. The results of the in-degree centrality are illustrated in Table 6 and in Figure 2.

Table 6. In-degree Centrality of Divisions

Division	Network In-degree Centrality at T2	Overall Rank at T2	Network In-degree Centrality at T4	Overall Rank at T4
Control D1	12.06%	5	12.06%	5
Control D2	2.06%	7	7.90%	8
Intervention 1 D3	2.38%	6	14.90%	4
Intervention 1 D4	14.76%	3	8.33%	7
Intervention 2 D5	1.63%	8	15.97%	3
Intervention 2 D6	17.75%	2	17.47%	2
Intervention 3 D7	22.60%	1	24.07%	1
Intervention 3 D8	14.71%	4	10.25%	6

The divisions with the most improved in-degree centrality measures were Division 3 and Division 5. Division 3 received the positive identity statement intervention while Division 5 received the small group debrief intervention combined with the positive identity statement intervention. Much like the density measure, the division that received the small group debrief intervention was again the most improved division compared to those that received a different intervention. Perhaps Division 5 reflected higher in-degree measures than other divisions because the small group debrief intervention informed recruits on resilience and the power of positive relationships, which they put into practice and reported accordingly. This also indicates that the influential people in Division 5 received many ties from other people compared to other divisions. It is also not surprising that Division 1 and Division 2 remained in the bottom half of the rankings during both time periods since neither received any interventions. These findings validate the first hypothesis that divisions with resilience interventions demonstrate higher density measures compared to divisions without interventions, as shown in Table 6 and in Figure 2.

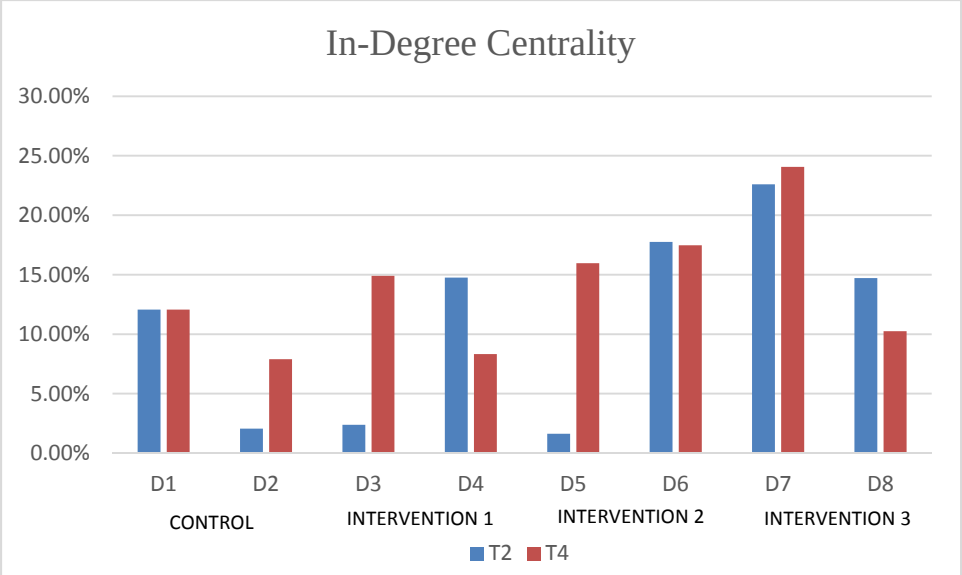

Figure 2. In-degree Centrality of Divisions at T2 and T4

b. Out-degree Centrality

In out-degree centrality measure, both Divisions 1 and 2, which received no intervention at T4, showed no change in their out-degree centrality values and remained in the same rank from T2 to T4. While Division 1 was ranked number two at both time periods, Division 2 became the lowest ranking division in terms of out-degree centrality at T4. On the other hand, Division 4, which received a positive identity statement intervention, decreased in rank from one to seven at T4. Division 6, with the highest out-degree centrality, received a small group debrief intervention combined with positive identity statement intervention, increased in rank from three at T2 to one at T4. The changes of the division's out-degree centrality measures at T2 and T4 are depicted in Table 7 and in Figure 3.

Table 7. Out-degree Centrality of Divisions at T2 and T4

Division	Network Out-degree Centrality at T2	Overall Rank at T2	Network Out-degree Centrality at T4	Overall Rank at T4
Control D1	59.37%	2	59.37%	2
Control D2	2.61%	8	15.59%	8
Intervention 1 D3	7.87%	6	51.97%	3
Intervention 1 D4	91.49%	1	16.08%	7
Intervention 2 D5	2.81%	7	41.37%	5
Intervention 2 D6	58.90%	3	90.29%	1
Intervention 3 D7	32.34%	4	29.27%	6
Intervention 3 D8	31.79%	5	50.40%	4

In this measure, Division 5 and Division 6, whose recruits received the small group debrief intervention combined with the positive identity statement intervention, were the most improved divisions with intervention measures compared to those with other interventions. Much like the correlation with in-degree centrality, the division that received the small group debrief intervention combined with the positive identity statement intervention performed better than those divisions with other interventions. Division 3 with the positive identity statement and Division 8 with the appreciative guided-conversation interventions suggest that more people reached out to other people and that more people exchanged ties with others.

What I deduce from the in-degree and out-degree centrality measures is that there is no overlap in the findings. With the exception of Division 5, which reflected high in-degree and out-degree centrality measures, people in the divisions that sought out other people were not necessarily the same people with which others sought connection. It appears that recruits in training develop connections that are not necessarily reciprocal. However, these findings also validate the first hypothesis that divisions with resilience interventions reflect higher density measures compared to divisions without resilience intervention, as illustrated in Table 7 and in Figure 3.

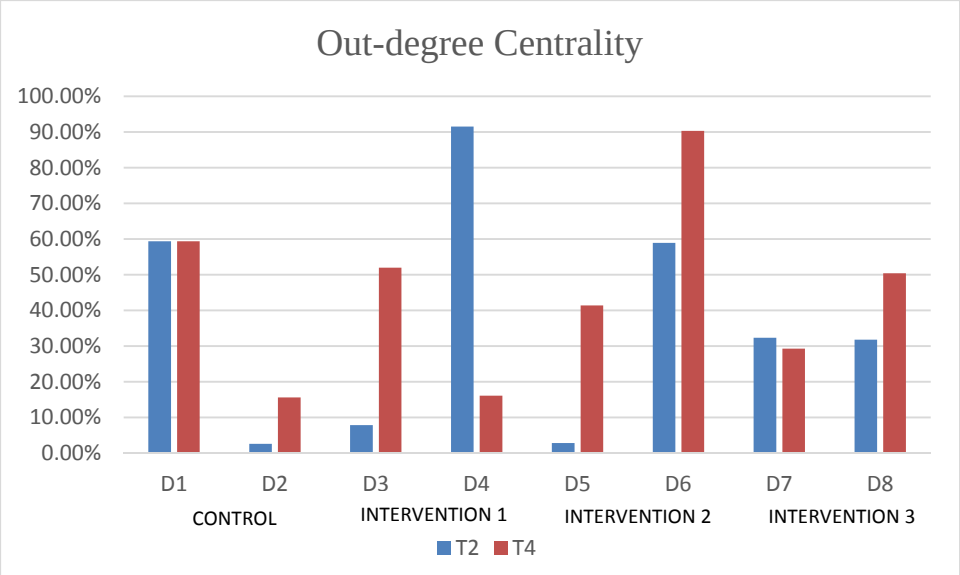

Figure 3. Out-degree Centrality of Divisions at T2 and T4

3. Leader Centrality

With the help of UCINET, I was able to identify which nodes had the highest in-degree and out-degree centralities within each division at T2 and T4. Since I am exploring the realm of positivity levels, I assume that the degree centrality of a node relates to the number of people that node is directly able to influence. It is, then, safe to assume that those with the highest in-degree and out-degree centralities correspond with leaders and influencers within the division. Since we were able to collect the leadership role of the recruits within the division, with the exception of one division, I was able to test whether my analysis was correct. I cross-referenced UCINET's node position within the network with that node's reported leadership position, if any, within the division. The top four leadership roles within the division from highest to lowest included the recruit chief petty officer (RCPO), recruit leading petty officer (RLPO), recruit master-at-arms (RMAA), and recruit yeoman (RYN).

In Division 1, the RLPO was in the top four nodes in-degree and out-degree centrality at T2. However, this individual did not retain this status at T4. No other individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

In Division 2, the RMAA and RLPO held two of the top four in-degree centralities at T2, but only the RLPO held one of the top four out-degree centrality at T2. No other individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

In Division 3, no individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

Division 4 was the only division for which we were unable to collect leadership position data; therefore, I was unable to compare in-degree and out-degree centralities against the leadership position of individuals in the division.

In Division 5, the RCPO received the highest in-degree centrality at T2 and T4. No other individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

In Division 6, the RCPO received the second highest in-degree centrality at T2. The RCPO remained in the top four at T4 although the in-degree centrality dropped from rank two to four. No other individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

In Division 7, the RMAA received the highest out-degree centrality at T2 but did not retain this status at T4. Similarly, the RLPO held one of the highest in-degree centralities at T2 but did not retain this status at T4. No other individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

In Division 8, the RCPO received the highest out-degree and in-degree centralities at T2. The RCPO remained in the top four highest in-degree and out-degree centralities but decreased in rank for both categories at T4. As depicted in Table 21, no other individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods.

Upon cross-referencing the highest in-degree and out-degree centralities against leadership roles of recruits in the division, those recruits with leadership position are not

necessarily the same recruits with prominence and influence in the network. The main take-away from this measure is that even though individuals are ranked with high in-degree centrality at T2, they are not necessarily keeping that status at T4. It could be that people have a change in their preferences or that the leaders in high-ranking positions also change over time. See Appendix A for leadership centrality tables.

4. Individual Resilience and Centrality

The centrality method also allowed me to compare the mean of the individuals' self-reported resilience scores with their mean positivity levels. I used Borgatti et al.'s centrality measures with UCINET to compare against the individuals' self-reported resilience at T2 and T4.

In this measure, the control group, Division 1, reflected an increase in average self-reported brief resilience of recruits, 4.01 to 4.78, and CD-RISC measures, 2.69 to 3.17. Conversely, UCINET's average centrality scores for in-degree and out-degree reflected a high decrease, 14.67 to 9.97 from T2 to T4, compared to Division 1's self-reported resilience measures. The other control group, Division 2, showed a slight increase in the average self-reported brief resilience of recruits, 4.49 to 4.62, and CD-RISC measures remained the same, 3.19, from T2 and T4. Similarly, UCINET's average centrality score for in-degree and out-degree reflected a very high increase, 0.68 to 9.31. For the treatment groups with positive identity statement intervention, Division 3 experienced an increase in the average self-reported brief resilience of recruits, 4.42 to 5.14, and CD-RISC measures, 3.05 to 3.48, from T2 to T4. On the other hand, UCINET's average centrality scores for in-degree and out-degree reflected a very high increase, 1.36 to 9.98, from T2 to T4 compared to the self-reported brief resilience scores. Division 4, which also received the positive identity statement intervention, showed a decrease in self-reported brief resilience and CD-RISC measures, 5.18 to 4.67 and 3.58 to 3.19, respectively, as well as UCINET's measures, 10.06 to 7.86, from T2 to T4. For the treatment group with small group debrief intervention as well as positive identity statement intervention, Division 5 experienced a decrease in the average self-reported brief resilience of recruits, 4.32 to 4.19, from T2 to T4. On the other hand, the CD-RISC

measures reported a slight increase, 3.02 to 3.2, at T4. Its UCINET average centrality scores for in-degree and out-degree, on the other hand, reflected a very large decrease, 9.55 to 2.5, from T2 to T4. Division 6, which also received both small group debrief and positive identity interventions, showed a slight decrease in both its self-reported brief resilience measures, 5.1 to 5.01, and UCINET's measures, 7.95 to 7.33, from T2 to T4. Conversely, the CD-RISC measures reported a very slight increase, 3.4 to 3.46, from T2 to T4. For the treatment group that received appreciative guided conversation intervention, Division 7 showed a slight increase in its self-reported brief resilience measures, 4.27 to 4.34, and an increase of its CD-RISC measures, 2.89 to 3.24. Its UCINET measures also reflected a slight increase, 0.65 to 2.32, from T2 to T4. Last, Division 8, which also received the appreciative guided conversation intervention, showed an increase in its self-reported resilience measures, 3.85 to 4.16, and CD-RISC measures, 2.79 to 3.07, at T4. Its UCINET measure reflected an increase as well, 6.45 to 10.79, at T4. All measures are depicted in Table 8.

Table 8. Individual Mean Resilience Scores at T2 and T4

Division	Description	T2	T4
Control D1	Brief Resilience Scale	4.01	4.78
Control D2	Brief Resilience Scale	4.49	4.62
Intervention 1 D3	Brief Resilience Scale	4.42	5.14
Intervention 1 D4	Brief Resilience Scale	5.18	4.67
Intervention 2 D5	Brief Resilience Scale	4.32	4.19
Intervention 2 D6	Brief Resilience Scale	5.1	5.01
Intervention 3 D7	Brief Resilience Scale	427	4.34
Intervention 3 D8	Brief Resilience Scale	3.85	4.16
Control D1	Connor-Davidson Resilience Scale	2.69	3.17
Control D2	Connor-Davidson Resilience Scale	3.19	3.19
Intervention 1 D3	Connor-Davidson Resilience Scale	3.05	3.48
Intervention 1 D4	Connor-Davidson Resilience Scale	3.58	3.19
Intervention 2 D5	Connor-Davidson Resilience Scale	3.02	3.2
Intervention 2 D6	Connor-Davidson Resilience Scale	3.4	3.46
Intervention 3 D7	Connor-Davidson Resilience Scale	2.89	3.24
Intervention 3 D8	Connor-Davidson Resilience Scale	2.79	3.07

There seems to be a correlation between individual resilience and in-degree and out-degree centralities. Division 3, which reflected high individual resilience measures, also reflected high centrality scores. This makes sense since Division 3 received the positive identity statement intervention that focused on fostering individual resilience. Division 8 reflected a slight increase in both its brief resilience and CD-RISC measures; however, its UCINET measures show a very large increase at T4. Division 8 received appreciative guided conversations that included a brief on resilience and power of positive relationships with the aim of developing personal relationships, which the data reflected to be effective in this category. No other divisions showed a significant pattern. However, this also validates the first hypothesis that divisions with resilience interventions should reflect higher centrality measures compared to divisions without interventions and strengthens my conclusion that resilience with interventions result in denser networks and improve cohesion. All measures are depicted in Tables 8 and 12.

I also performed an analysis of variance (ANOVA) using the mean in-degree centrality, the mean out-degree centrality, and the mean density to determine whether there were any statistical differences at T2 and T4. The p-value was used to determine whether the difference was statistically significant. A p-value of less than 0.05 is considered statistically significant. The results of the ANOVA confirm my earlier hypothesis, that the average of the treatment groups was statistically significantly higher and better than that of the control groups in terms of in-degree centrality, out-degree centrality and density. The ANOVA tests revealed a p-value larger than 0.05 for all categories which proves that there is strong evidence to support this hypothesis. Moreover, the differences at T2 and T4 reveal higher averages at T4 than at T2 for both treatment and control groups as shown in Tables 9, 10 and 11.

Table 9. In-degree ANOVA Results

T2 In-Degree ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Control	2	0.14116	0.07058	0.004996
Intervention 1	2	0.1714	0.0857	0.007663
Intervention 2	2	0.1938	0.0969	0.012993
Intervention 3	2	0.3731	0.18655	0.003113

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.016352	3	0.005451	0.757963	0.573132	6.591382
Within Groups	0.028765	4	0.007191			
Total	0.045116	7				

T4 In-degree ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Control	2	19.96	9.98	8.6528
Intervention 1	2	23.23	11.615	21.58245
Intervention 2	2	33.44	16.72	1.125
Intervention 3	2	34.32	17.16	95.4962

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	78.32744	3	26.10915	0.823266	0.545405	6.591382
Within Groups	126.8565	4	31.71411			
Total	205.1839	7				

Table 10. Out-degree ANOVA Results

T2 Out-degree ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Control	2	61.98	30.99	1610.849
Intervention 1	2	99.36	49.68	3496.152
Intervention 2	2	61.71	30.855	1573.044
Intervention 3	2	64.13	32.065	0.15125

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	508.3115	3	169.4372	0.101456	0.954986	6.591382
Within Groups	6680.196	4	1670.049			
Total	7188.508	7				

T4 Out-degree ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Control	2	74.96	37.48	958.3442
Intervention 1	2	68.05	34.025	644.0461
Intervention 2	2	131.66	65.83	1196.583
Intervention 3	2	79.67	39.835	223.2385

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1271.13	3	423.71	0.560794	0.668798	6.591382
Within Groups	3022.212	4	755.553			
Total	4293.342	7				

Table 11. Density ANOVA Results

T2 Density ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Control	2	0.708	0.354	0.014792
Intervention 1	2	0.821	0.4105	0.001013
Intervention 2	2	0.528	0.264	0.000002
Intervention 3	2	0.576	0.288	0.000392

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.026346	3	0.008782	2.168627	0.234374	6.591382
Within Groups	0.016199	4	0.00405			
Total	0.042545	7				

T4 Density ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Control	2	0.405	0.2025	0.027613
Intervention 1	2	0.491	0.2455	0.041761
Intervention 2	2	0.754	0.377	9.8E-05
Intervention 3	2	0.594	0.297	0.0018

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.033787	3	0.011262	0.632085	0.632028	6.591382
Within Groups	0.071271	4	0.017818			
Total	0.105058	7				

Table 12. UCINET Mean Centrality Scores (In-degree and Out-degree)

Division	UCINET In-degree Centrality T2	UCINET In-degree Centrality T4	UCINET Out-degree Centrality T2	UCINET Out-degree Centrality T4
Control D1	14.67	9.97	14.67	9.97
Control D2	0.68	9.31	0.68	9.31
Intervention 1 D3	1.36	9.98	1.36	9.98
Intervention 1 D4	10.06	7.86	10.06	7.86
Intervention 2 D5	9.55	2.5	9.55	2.5
Intervention 2 D6	7.95	7.33	7.95	7.33
Intervention 3 D7	0.65	2.32	0.65	2.32
Intervention 3 D8	6.45	10.79	6.45	10.79

The centrality method also allowed me to compare the recruit training division's self-reported average scores with average positivity levels. I used the network centrality measures of Borgatti et al. in UCINET to compare against the divisions' self-reported resilience at T2 and T4. The data we collected only had self-reported cohesion and procedural justice measures at T2. Since UCINET expressed the network centrality in percentages, I also obtained the division's average scores expressed in percentages. When expressing centrality network in percentages, the lower the percentage means the lower the centrality of the network. Conversely, the higher the percentage means the higher the centrality of the network.

5. Organizational Resilience, Centrality and Cohesion

At the organizational level, I compared the procedural justice scores to UCINET's out-degree centrality scores and the cohesion scores to UCINET's in-degree centrality scores. The divisions' resilience scores were compared to both UCINET's in-degree and out-degree centrality scores. For Division 1, one of the control groups, the procedural justice score reflected 44 percent while the UCINET out-degree centrality reported a higher score of 55.95 percent at T2. Division 2, the other control group, received a procedural justice score of 48 percent while the UCINET out-degree centrality reflected a very low 2.61 percent. For Division 3, that treatment group that received the positive identity statement intervention, the procedural justice score reflected 49 percent while the

UCINET out-degree centrality reflected only 7.87 percent. On the other hand, Division 4, the treatment group that received the positive identity statement intervention, received a procedural justice score of only 46 percent while the UCINET out-degree centrality score reflected a very high score of 91.49 percent. Division 5, the group that received small group debrief and positive identity statement intervention, received a procedural justice score of 48 percent while the UCINET out-degree reflected a much lower score of 2.81 percent at T2. Division 6's procedural justice score reflected 43 percent while its UCINET out-degree centrality reflected a low 15.59 percent at T2. For Division 7, which received appreciative guided conversation intervention, the procedural justice score reflected 55 percent while the UCINET out-degree centrality reflected a lower score of 32.34 percent. Last, Division 8's procedural justice score reflected 53 percent while its UCINET's out-degree centrality score was only 31.79 percent. All measures are depicted in Tables 13, 16, and 17.

Table 13. Division Procedural Justice Mean Scores at T2

Division	Description	Mean at T2	Percentage at T2
Control D1	Procedural Justice	3.11	44%
Control D2	Procedural Justice	3.37	48%
Intervention 1 D3	Procedural Justice	3.43	49%
Intervention 1 D4	Procedural Justice	3.22	46%
Intervention 2 D5	Procedural Justice	3.37	48%
Intervention 2 D6	Procedural Justice	2.99	43%
Intervention 3 D7	Procedural Justice	3.85	55%
Intervention 3 D8	Procedural Justice	3.71	53%

The results for Division 1's cohesion score reflected 49 percent while its UCINET in-degree centrality score reflected only 22.63 percent. Division 2's cohesion score reflected 49 percent while its UCINET in-degree centrality score reflected a very low 2.06 percent. The results for Division 3's cohesion score reflected 48 percent while its UCINET in-degree centrality score reflected a very low 2.38 percent. Division 4's cohesion score reflected 50 percent while its UCINET in-degree centrality score reflected a low 14.76 percent. Division 5's cohesion reflected 50 percent while its UCINET in-

degree centrality score reflected a very low 1.63 percent. Division 6's cohesion score reflected 43 percent while its UCINET in-degree centrality score reflected only 7.90 percent. Division 7's cohesion score reflected 59 percent while its UCINET in-degree centrality score reflected a mere 22.60 percent. Division 8's cohesion score reflected 54 percent while its UCINET in-degree centrality score reflected a low 14.71 percent. All measures are depicted in Tables 14, 16, and 17.

Table 14. Division Cohesion Mean Scores at T2

Division	Description	Mean at T2	Percentage at T2
Control D1	Cohesion	3.4	49%
Control D2	Cohesion	3.46	49%
Intervention 1 D3	Cohesion	3.34	48%
Intervention 1 D4	Cohesion	3.47	50%
Intervention 2 D5	Cohesion	3.47	50%
Intervention 2 D6	Cohesion	2.99	43%
Intervention 3 D7	Cohesion	4.16	59%
Intervention 3 D8	Cohesion	3.81	54%

The resilience score for Division 1 showed an increase from 52 percent to 60 percent while its UCINET in-degree centrality reflected a decrease from 22.63 percent to 12.06 percent and its out-degree centrality reflected a slight increase from 55.95 percent to 59.37 percent at T4. Division 2's resilience score increased from 53 percent to 57 percent while its UCINET in-degree centrality reflected an increase from 2.06 percent to 17.75 percent and its UCINET out-degree centrality reflected large increase from 2.61 percent to 58.90 percent. The resilience score for Division 3 reflected an increase from 53 percent to 60 percent while its UCINET in-degree and out-degree network centrality scores also reflected an increase. Although both measures reflected the same pattern, UCINET's measure of 2.38 percent to 14.90 percent was still lower than the reported scores. Division 4 showed a slight decrease in its resilience score from 54 percent to 52 percent. Its UCINET in-degree and out-degree network centrality scores also decreased from 14.76 percent to 8.33 percent and 91.49 percent to 16.08 percent, respectively. Division 5 also reflected an increase in its resilience score from 56 percent to 63 percent

while its in-degree centrality reflected a large increase from 1.63 percent to 15.97 percent with a large increase in its out-degree centrality score from 2.81 percent to 41.37 percent. Division 6's resilience score reflected an increase from 50 percent to 57 percent while its UCINET in-degree centrality also reflected an increase from 7.90 percent to 17.47 percent and its UCINET out-degree centrality reflected a very large increase from 15.59 percent to 90.29 percent. Division 7, on the other hand, reflected a decrease in its resilience score, from 66 percent to 61 percent. Division 7's UCINET out-degree network centrality reflected a decrease as well, from 32.34 percent to 29.27 percent. Division 7's UCINET in-degree score, on the other hand, reflected an increase from 22.60 percent to 24.07 percent. Last, Division 8's resilience score reflected a decrease from 65 percent to 60 percent while its UCINET in-degree network centrality reflected the same direction from 14.71 percent to 10.25 percent. Division 8's out-degree network centrality, on the other hand, reflected an increase from 31.79 percent to 50.40 percent. All measures are depicted in Tables 15, 16, and 17.

Table 15. Division Resilience Mean Scores at T2 and T4

Division	Description	Average at T2	Average at T4	Percentage at T2	Percentage at T4
Control D1	Division Resilience Scale	3.62	4.18	52%	60%
Control D2	Division Resilience Scale	3.7	3.98	53%	57%
Intervention 1 D3	Division Resilience Scale	3.69	4.18	53%	60%
Intervention 1 D4	Division Resilience Scale	3.81	3.62	54%	52%
Intervention 2 D5	Division Resilience Scale	3.95	4.4	56%	63%
Intervention 2 D6	Division Resilience Scale	3.48	4.02	50%	57%
Intervention 3 D7	Division Resilience Scale	4.65	4.27	66%	61%
Intervention 3 D8	Division Resilience Scale	4.53	4.2	65%	60%

Within the three categories of division resilience, cohesion, and procedural justice, few inferences can be made to identify trends in the data. However, one division that stood out was Division 7, whose resilience measure average from T2 to T4 reflected 63.5 percent, which is the highest in that category. In addition, its cohesion reflected 59 percent and its procedural justice reflected 55 percent, both of which were the highest measure in those categories. Division 7 received appreciative guided conversation, which focused on encouraging recruits to develop group cohesion and improve positive relationships. Therefore, an assumption can be made that divisions with high resilience measures also reflected higher cohesion and sense greater procedural justice compared to divisions with no intervention, as suggested in my second hypothesis. However, it is also important to note that the self-reported measures reflected higher levels than that of the computer-generated UCINET measures. The reason why the self-reported measures were higher may be the result of the recruit's initial reactions at the time they filled out the survey. All measures are shown in Tables 13, 14, 15, 16, and 17.

Table 16. UCINET Network In-degree Centrality Scores

Division	UCINET In-degree Network Centrality at T2	UCINET In-degree Network Centrality at T4
Control D1	22.63%	12.06%
Control D2	2.06%	17.75%
Intervention 1 D3	2.38%	14.90%
Intervention 1 D4	14.76%	8.33%
Intervention 2 D5	1.63%	15.97%
Intervention 2 D6	7.90%	17.47%
Intervention 3 D7	22.60%	24.07%
Intervention 3 D8	14.71%	10.25%

Table 17. UCINET Network Out-degree Centrality Scores

Division	UCINET Out-degree Network Centrality at T2	UCINET Out-degree Network Centrality at T4
Control D1	55.95%	59.37%
Control D2	2.61%	58.90%
Intervention 1 D3	7.87%	51.97%
Intervention 1 D4	91.49%	16.08%
Intervention 2 D5	2.81%	41.37%
Intervention 2 D6	15.59%	90.29%
Intervention 3 D7	32.34%	29.27%
Intervention 3 D8	31.79%	50.40%

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V. CONCLUSIONS

The purpose of this research was to build on previous studies of Navy recruit resilience to understand and analyze a recruit's ability to bounce back from adversity. I focused my analysis on the positive energy of individuals to identify trends in recruit interaction. I used control and treatment groups to observe how patterns of relationships align with positivity levels. My goal was to emphasize on the role and functions of positive energy levels and social networks as they correlate with resilience. Since there is very little research on social networks of naval recruits, I intended to create a foundation of information for any future studies in the fields of resilience, positive energy, or social networks.

In Chapter I, I provided background information on Navy recruits in training and an overview of this research study. In Chapter II, I explored the various studies in the field of positive energy in organizations, resilience, and social networks. In Chapter III, I described the methodology, which comprised the methods used by Borgatti et al., Connor & Davidson, and Cross et al. In Chapter IV, I described the implementation of the hybrid methodology used in this study. In Chapter V, I described the network results executed in this study, depicted the social network and presented a visual comparison of social networks for the control groups and treatment groups in Appendix C.

A. CONCLUSIONS

This thesis focused on the following research questions for each training division studied as they related to the social networks of Navy recruits:

1. How does positive energy of recruits within the social network differ between the control groups and the treatment groups?

2. How do we explain the differences between the positive energy levels and the degree of resilience levels reported by each division?

3. What is the relationship between specific survey measures (individual and organizational resilience, cohesion, and procedural justice) and network characteristics (degree of centrality, density, cohesion and distance)?

To answer the first question, I utilized the degree centrality of a node, which measured individual energy levels, to cross-reference the node's position in the network with its reported leadership position. In Division 1, the recruit leading petty officer (RLPO) was in the top four nodes in-degree and out-degree centrality at T2. However, the individual did not retain this status at T4. In Division 2, the RMAA and RLPO held two of the top four in-degree centralities at T2, but only the RLPO held one of the top four out-degree centralities at T4. In Division 3, no individuals with the top in-degree and out-degree centralities held a significant position in the division during both time periods. Division 4 was the only division for which we were unable to collect leadership position data; therefore, I was unable to compare in-degree and out-degree centralities against the leadership position of individuals in the division. In Division 5, the recruit chief petty officer (RCPO) received the highest in-degree centrality at T2 and T4. In Division 6, the RCPO received the second highest in-degree centrality at T2. The RCPO remained in the top four at T4 although the in-degree centrality dropped from rank two to four. In Division 7, the recruit master-at-arms (RMAA) received the highest out-degree centrality at T2 but did not retain this status at T4. Similarly, the RLPO held one of the highest in-degree centralities at T2 but did not retain this status at T4. Last, in Division 8, the RCPO received the highest out-degree and in-degree centralities at T2. The RCPO remained in the top four highest in-degree and out-degree centralities but decreased in rank for both categories at T4.

Although there is evidence that some nodes with a prominent position in the network held a leadership position in the division, there is not enough evidence in the data to conclude that those in the position of leadership were necessarily more prominent in the social network. It might be that there were other factors or attributes that made other nodes more prominent than just their leadership position in the division.

I also utilized centrality measures in UCINET to compare the individuals' self-reported resilience, collected from all divisions at T2 and T4. Out of all the divisions, only three out of six divisions that received interventions– Divisions 3, 7, and 8– had an increase in their individuals' self-reported resilience measures as well as their UCINET measures. The other three divisions, Division 4, 5, and 6, all had a decrease in their

individuals' self-reported resilience and UCINET measures. Surprisingly, the control group, Divisions 1 and 2, both had a slight increase in their individuals' self-reported resilience measures while their UCINET measures decreased. In this part of the analysis, the self-reported resilience of divisions with interventions followed the same pattern as UCINET measures, while the self-reported resilience of divisions without interventions contradicted the UCINET measures.

To answer the second question, I ranked the strongest and weakest divisions at T2 and T4 based on their density and centrality measures. At T2, the division with the highest density Division 1 control group, with a 0.440 density. Meanwhile the Division 2 control group reflected the lowest density at T4, 0.085. At T4, Division 3, which received the positive identity statement intervention reflected the highest density, 0.390, while Division 2, the division with the lowest density, 0.085, received no intervention. Division 5 also improved in density, from 0.265 density at T2 to 0.370 at T4, which changed its rank from seven to three at T4. No other divisions with interventions resulted in the same outcomes as Divisions 5 and 6. Other divisions had inconsistent results.

Overall, the division with the least improved density, Division 4, which received the positive identity statement intervention, had a density of 0.388 at T2 that dropped to 0.101 at T4. On the other hand, the division with the most improved density, Division 6, which received the small group debrief and positive identity statement interventions, had a density of 0.263 at T2 that increased to 0.384 at T4. Therefore, Division 2 is considered the weakest division while Division 6 is considered the strongest division in terms of density rankings. This part of the analysis also confirms my hypothesis and suggests that divisions with interventions had denser positive energy networks than divisions that received no interventions. Moreover, divisions with combined interventions demonstrated denser networks. This means that higher density results are attained when interventions are combined, as seen with Divisions 5 and 6, and that not one intervention alone can produce the same results.

I also measured the *in-degree centrality*, or the number of ties the node received, to determine the strongest and weakest divisions at T2 and T4. Division 7, which received guided conversation intervention, reflected the highest in-degree centrality in the

network at T2 and T4, with 22.60 percent and 24.07 percent, respectively. This means Division 7 was the strongest division during both time periods in terms of in-degree centrality. At T2, Division 5 received a 1.63 percent in-degree centrality, which makes it the weakest division. On the other hand, Division 2, which received no intervention, remained at the very bottom of the rankings at T4. Division 2 started from rank seven at T2 to rank eight at T4, making it the weakest division in terms of in-degree centrality.

I also measured the *out-degree* centrality of each division, the number of ties the node exchanged with other nodes. In this measure, Division 4 showed the strongest connection, with 91.49 percent. Meanwhile, Division 2 showed the weakest connection at T2, with 2.61 percent. At T4, Division 6 showed the strongest out-degree centrality, making it the strongest division, with 90.29 percent, while Division 2 was the weakest division, with 15.59 percent at T4. In terms of out-degree centrality, the strongest divisions, Division 4 at T2 and Division 6 at T4, received interventions while the weakest division, Division 2 at T2 and T4, received no interventions.

In most cases, the divisions that received interventions either remained at the same rank or increased in rank. The control groups, on the other hand, did not improve or in some cases, they worsened. Therefore, I conclude that the treatment groups that received interventions were more likely to improve their status than those divisions that were in the control groups.

To provide another answer to the second question, I also utilized the density and in terms of density measures, both control groups, Divisions 1 and 2, showed a decrease in rank from T2 to T4. The treatment groups, on the other hand, were divided into three categories. Division 3 showed an increase in rank while Division 4 decreased in rank. While both divisions which received positive identity statement and small group debrief interventions both increased in rank. On the other hand, Division 7 remained in the same rank while Division 8 decreased in rank from T2 to T4.

As another conclusion to the second question, for the divisions that received interventions, two divisions remained at the same rank, two divisions showed an increase in rank, and two divisions showed a decrease in rank. In this category, both control

groups decreased in rank. Therefore, in terms of density, I also conclude that the treatment groups that received interventions were more likely to improve their status than those divisions that were in the control groups.

Another conclusion to the second question is that the treatment groups that received interventions were more likely to improve the appearance of their network than those divisions that were in the control groups. These visualizations are derived directly from the valued data of the self-reported positive energy levels of recruits. For the control groups in this category, Division 1's network appeared more spread out with some prominent nodes at T2 while its network appeared smaller with some outlier nodes at T4. Division 2's network looked more clustered with many prominent nodes, which appeared to have thinned out significantly by T4. For the positive identity statement intervention, Division 3's network appeared almost exactly the same at T2 and T4 although some nodes seem to have changed their position of prominence in the network; while Division 4's network appeared more spread out with many prominent nodes at T2, but surprisingly, the network appeared to have far fewer connections and less density with many outlier nodes at T4. For the small group debrief intervention, Division 5's network appeared more spread out with evenly prominent nodes throughout at T2 and appeared about the same size but with more prominent nodes throughout the network at T4; while Division 6's network looked very closely knit with evenly spread out prominent nodes in the middle at T2 but appeared with more prominent nodes spread evenly, making a very thick web of a network by T4. For the appreciative guided conversation intervention, Division 7's network appeared more spread out with many prominent nodes at T2 and appeared smaller and less dense with more outlier nodes at T4; while Division 8's network appeared to have good clusters and more density in one area at T2 yet had the same consistency with a few less prominent nodes at T4.

In this part of the analysis, there seemed to have been significant improvement to the networks for the treatment groups compared to the control groups although I observed that all networks, regardless of intervention, naturally changed over time. See Appendix C for a network visualization of positive energy.

Again, for the second question, there was not much of a difference in the direction of the positive energy levels and the degree of self-reported measures. In other words, most of the divisions that reflected an increase in positive energy levels also reflected an increase in self-reported measures. Conversely, the divisions that reflected a decrease in positive energy levels also reflected a decrease in self-reported measures. The data suggests that there is a positive correlation between positive energy levels and resilience. In some instances there had been some negative correlation, however there was still a relationship that linked positivity levels and resilience at both the individual and the organizational levels.

To answer the third question, I utilized centrality measures with UCINET to compare against the divisions' self-reported resilience at T2 and T4. The rest of the data, on procedural justice and cohesion, were collected only during T2, so I made the UCINET comparison for only T2 as well. The results reflected the same pattern as my earlier analysis for the most part. The control groups, Divisions 1 and 2, reflected low self-reported brief resilience, cohesion and procedural justice measures. Conversely, their UCINET measures reflected higher than the treatment groups. Most of the treatment groups reflected higher values in both self-reported and UCINET measures. Among the treatment groups, the most notable was Division 7 whose self-reported brief resilience, cohesion, and procedural average scores reflected the highest measures, its UCINET in-degree average centrality reflected an increase, and its out-degree average centrality reflected a decrease. Division 8's self-reported brief resilience average and its UCINET in-degree average centrality reflected a decrease while its out-degree average centrality reflected an increase.

For the most part, the control groups' self-reported resilience, cohesion and procedural justice scores were much lower than that of the treatment groups. As hypothesized earlier, I can confirm that divisions with resilience interventions demonstrated higher cohesion and sensed greater procedural justice compared to those divisions without interventions. Also, in terms of procedural justice and cohesion, the self-reported averages were reported at higher levels than UCINET's calculated measures at T2.

The results in this thesis suggests that there is a positive correlation between positive energy levels and resilience. The results also suggest that divisions with high resilience tend to have denser networks and greater cohesion. Utilizing interventions in basic training has implications on all four concepts as shown in this study. This leads me to believe that resilience, if developed in the early stages of basic training, can improve over time. However, this study also points out that greater cohesion, based on in-degree and out-degree centralities, and denser networks cannot be achieved through one intervention alone, but by combining two interventions such as positive identity statement and small group debrief, as used in this study.

B. FUTURE WORK

There is still a vast amount of data collected during this. I recommend further research to evaluate the other network questions in the data. Follow-on studies can expand the resilience study on this group of recruits. Moreover, due to funding constraints, this study only evaluated how relationships and social networks changed among recruits within divisions during their training at RTC. A more comprehensive study is preferred and recommended to evaluate the changes of social network structures at subsequent training schools or future commands.

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APPENDIX A. METHODOLOGY MATRICES

A. TWO-DIMENSIONAL MATRIX

New_ID	2988	5057	8557	8595	1285	1869	3214	5296	2471	6512
2988	0	1	0	0	0	0	0	0	0	0
5057	3	0	0	0	3	3	0	0	3	0
8557	0	0	0	0	0	0	0	0	0	0
8595	0	0	1	0	0	3	0	0	0	0
1285	0	1	0	0	0	1	0	0	0	0
1869	0	3	2	3	3	3	2	0	2	2
3214	0	0	2	2	0	3	0	3	0	2
5296	0	0	1	1	0	0	2	0	0	0
2471	1	2	1	1	1	3	1	1	0	1
6512	0	0	0	0	0	2	2	0	0	3

B. TWO-DIMENSIONAL MATRIX WITH "MISSING" DATA

New ID	6512	8610	6287	1141	8340	3909	7086
6512	3	0	0	3	0	0	0
8610	3	0	0	3	0	0	0
6287	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
1141	2	1	0	0	0	0	0
8340	0	0	0	0	0	0	1
3909	0	0	0	0	3	0	0
7086	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING

C. TWO-DIMENSIONAL ATTRIBUTES MATRIX

New ID	GNDR	RATE	AGE	DT RCD	AFQT	VE	YRS	CRT
2988	F	FR	19	16-Jun-15	39	44	12	L
5057	F	SR	19	16-Jun-15	53	49	12	L
8557	M	SN	18	12-Jun-15	77	56	12	L
8595	M	SN	33	16-Jun-15	56	50	16	K
1285	F	AR	19	16-Jun-15	59	48	12	L
1869	M	SR	23	16-Jun-15	86	58	12	L
3214	M	FR	21	11-Jun-15	62	54	12	L
5296	M	AR	18	15-Jun-15	67	53	12	L
2471	F	AN	20	16-Jun-15	80	60	12	L

APPENDIX B. LEADER CENTRALITY

A. D1 AND D2 INDIVIDUAL CENTRALITY AND LEADERSHIP POSITION: CONTROL GROUPS

D1 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
4723	36.905	RLPO		1869	69.643	None
9421	32.738	None		4463	48.81	None
1869	29.762	None		5945	37.5	None
8557	27.381	None		4723	35.119	RLPO

D1 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
1869	22.764	None		1869	69.512	None
5945	22.764	None		3214	36.179	None
6512	22.358	None		4463	36.179	None
9421	21.951	None		5057	34.146	None

D2 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
3782	2.681	None		6027	3.225	None
5844	2.603	None		5844	2.448	None
2330	2.214	RMAA		2297	2.409	RLPO
2297	2.02	RLPO		4145	2.292	None

D2 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
5164	10.127	None		5844	17.722	None
4853	9.283	None		2781	17.722	None
3782	8.017	None		4570	17.722	None
2895	6.751	None		9145	11.392	None

B. D3 AND D4 INDIVIDUAL CENTRALITY AND LEADERSHIP POSITION: RECEIVED INTERVENTION 1–POSITIVE IDENTITY STATEMENT INTERVENTION

D3 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
1379	3.704	None		8236	9.125	None
5481	2.845	None		6261	8.964	None
2836	2.738	None		6084	8.803	None
7154	2.684	None		8299	6.871	None

D3 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
2836	24.691	None		6084	61.317	None
3155	21.399	None		1850	46.914	None
5481	20.576	None		1379	39.506	None
8474	20.576	None		5481	32.922	None

D4 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
3933	24.138	Data not available		7363	100	Data not available
9014	24.138	Data not available		6201	55.556	Data not available
2891	21.456	Data not available		3422	52.107	Data not available
9832	19.54	Data not available		6460	39.08	Data not available

D4 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
9832	10.728	Data not available		4727	18.391	Data not available
3933	8.812	Data not available		2143	17.241	Data not available
8023	7.663	Data not available		3030	14.559	Data not available
3422	6.897	Data not available		1290	13.027	Data not available

C. D5 AND D6 INDIVIDUAL CENTRALITY AND LEADERSHIP POSITION: RECEIVED INTERVENTION 2–SMALL GROUP DEBRIEF INTERVENTION

D5 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
2438	2.3	RCPO		7744	3.468	None
4993	1.825	None		7713	2.994	None
2246	1.387	None		8654	2.848	None
5828	1.314	None		6611	2.702	None

D5 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
2438	25.098	RCPO		1394	50.196	None
5383	20.784	None		4079	41.569	None
2067	18.039	None		5861	39.608	None
4840	16.863	None		7713	37.647	None

D6 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
8658	23.984	None		6129	64.634	None
7518	21.951	RCPO		9767	50	None
1752	17.886	None		8710	42.683	None
3262	13.821	None		5796	32.114	None

D6 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
1763	28.049	None		6129	100	None
8658	26.423	None		1763	53.659	None
5424	25.61	None		3172	47.967	None
7518	24.797	RCPO		9827	42.276	None

D. D7 AND D8 INDIVIDUAL CENTRALITY AND LEADERSHIP POSITION: RECEIVED INTERVENTION 3–APPRECIATIVE GUIDED CONVERSATION INTERVENTION

D7 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
6265	32.323	None		6060	41.919	RMAA
2131	32.323	None		1214	41.919	None
1340	25.758	None		3622	41.414	None
3101	21.717	None		6553	40.909	None

D7 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
6265	31.624	None		6713	36.752	None
2131	23.932	None		2961	26.068	None
5708	20.085	None		6618	24.786	None
9092	17.949	RLPO		1696	22.65	None

D8 at T2						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
4353	22.49	RCPO		4353	39.357	RCPO
3418	19.679	None		2551	38.554	None
7144	18.876	None		1796	29.317	None
7497	18.072	None		9562	26.506	None

D8 at T4						
Node ID	In-degree	Leadership Position		Node ID	Out-degree	Leadership Position
7144	17.46	None		5584	57.143	None
3418	17.46	None		4353	28.968	RCPO
4353	16.667	RCPO		5939	28.175	None
3343	16.27	None		5026	23.413	None

APPENDIX C. NETWORK VISUALIZATION OF POSITIVE ENERGY

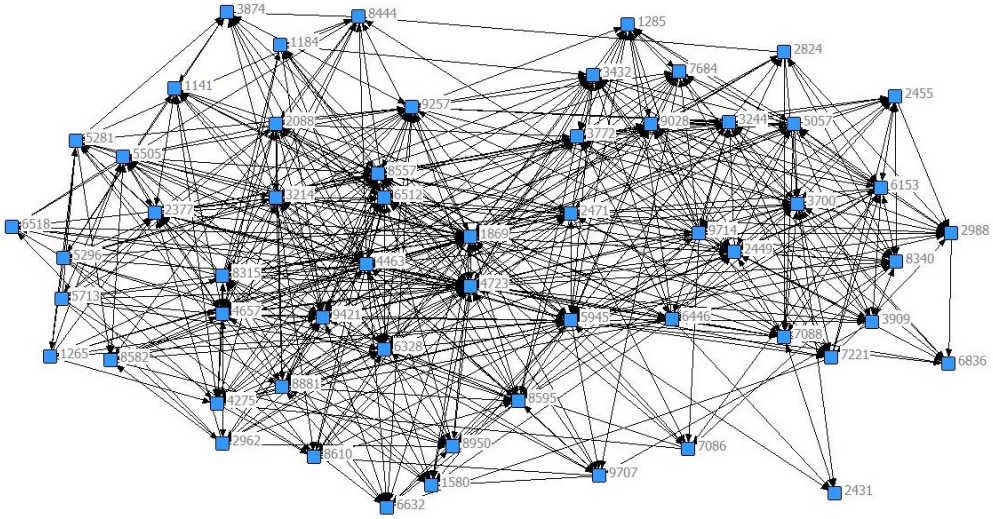

Figure 4. Positive Energy of Division 1 at T2: Received No Intervention

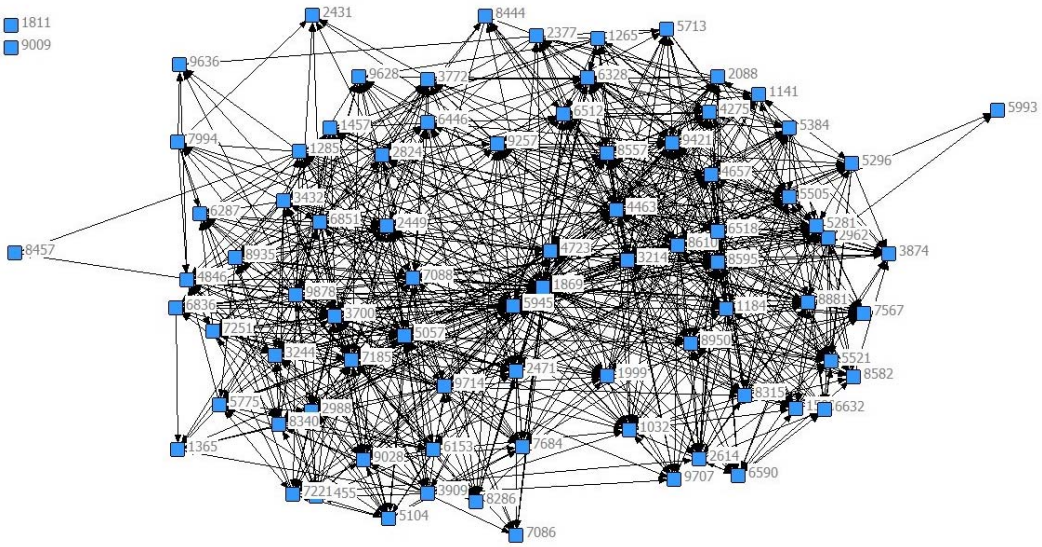

Figure 5. Positive Energy of Division 1 at T4: Received No Intervention

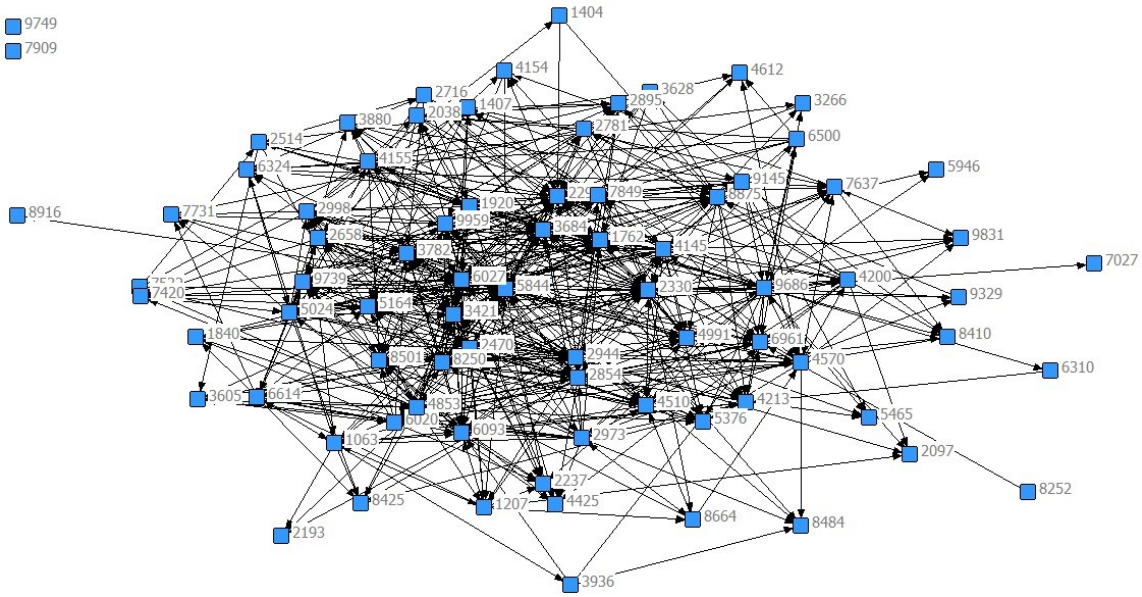

Figure 6. Positive Energy of Division 2 at T2: Received No Intervention

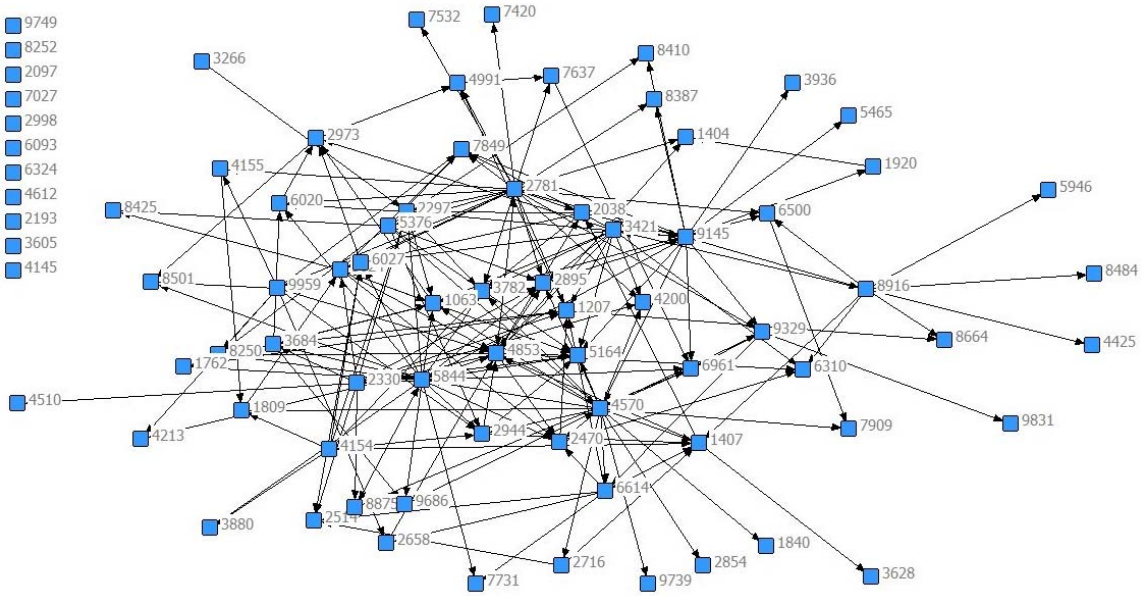

Figure 7. Positive Energy of Division 2 at T4: Received No Intervention

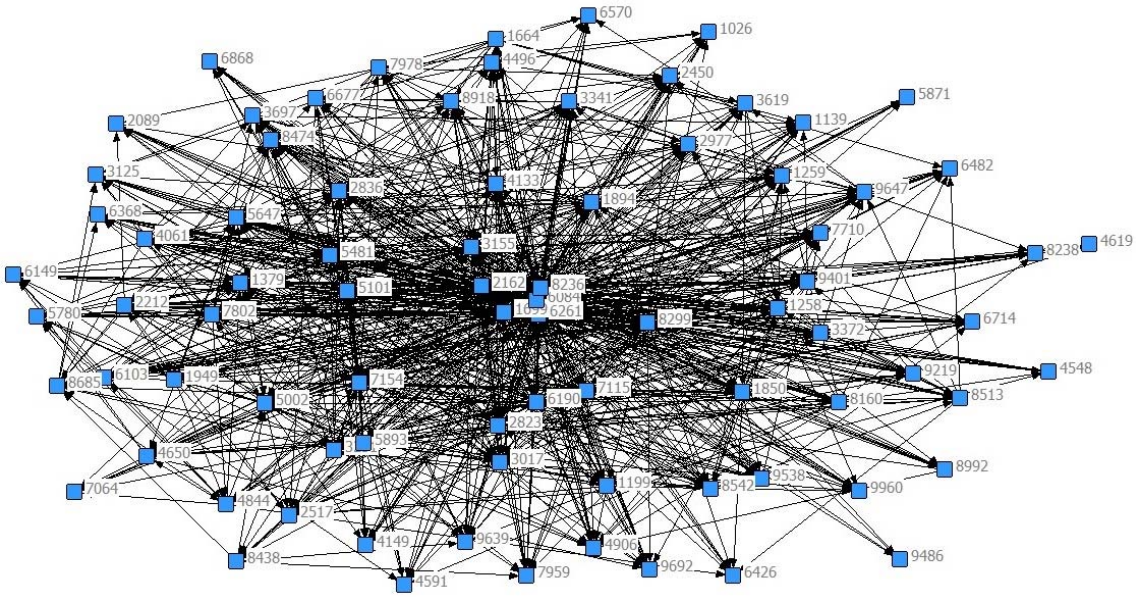

Figure 8. Positive Energy of Division 3 at T2: Received Positive Identity Statement Intervention

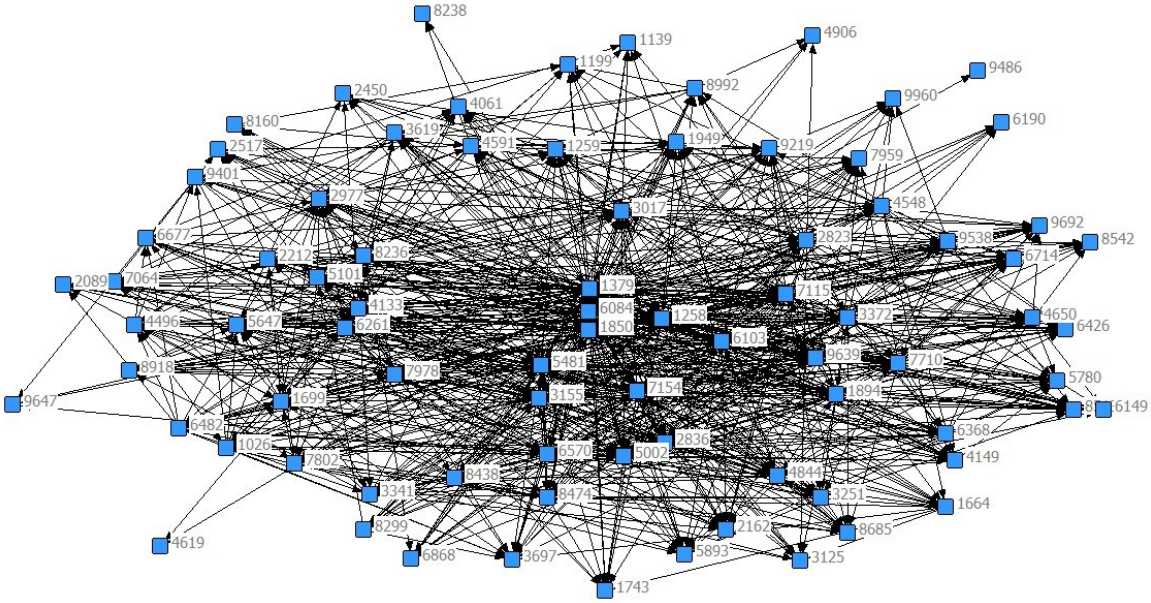

Figure 9. Positive Energy of Division 3 at T4: Received Positive Identity Statement Intervention

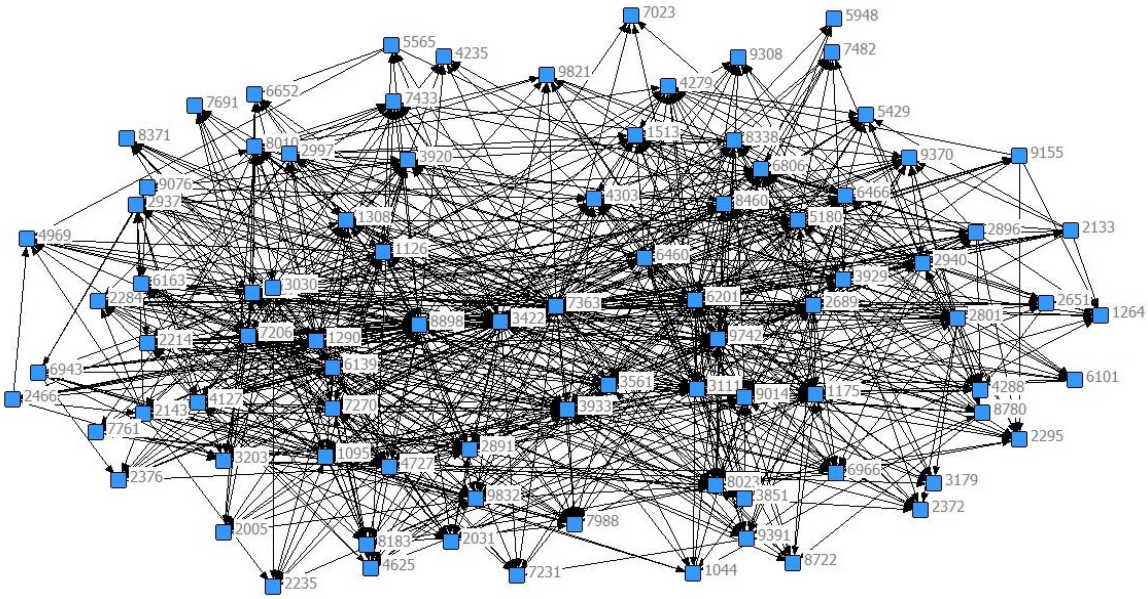

Figure 10. Positive Energy of Division 4 at T2: Received Positive Identity Statement Intervention

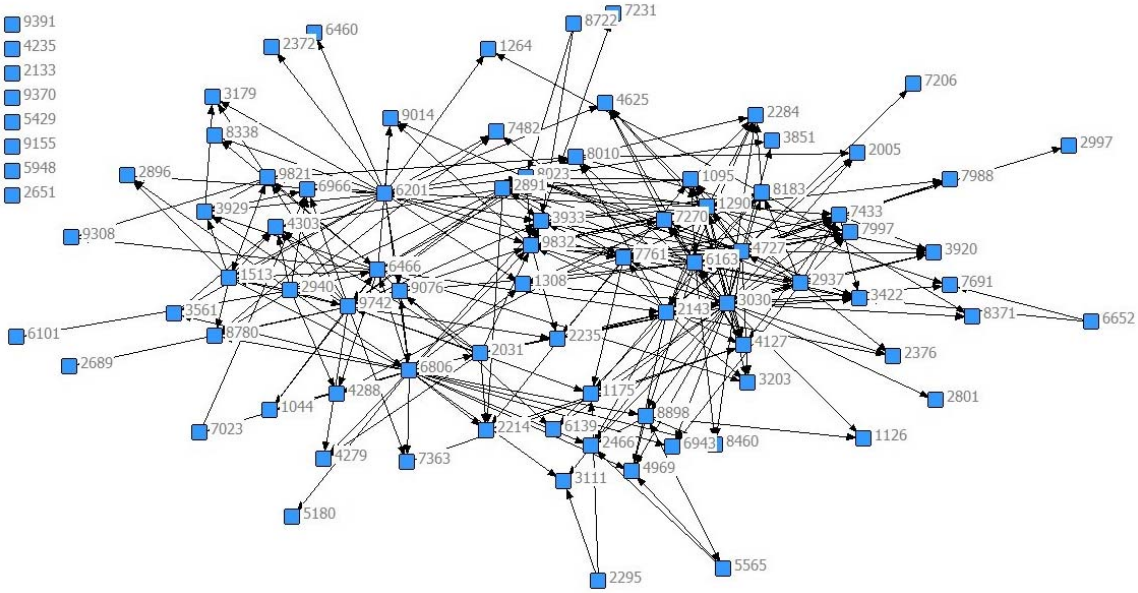

Figure 11. Positive Energy of Division 4 at T4: Received Positive Identity Statement Intervention

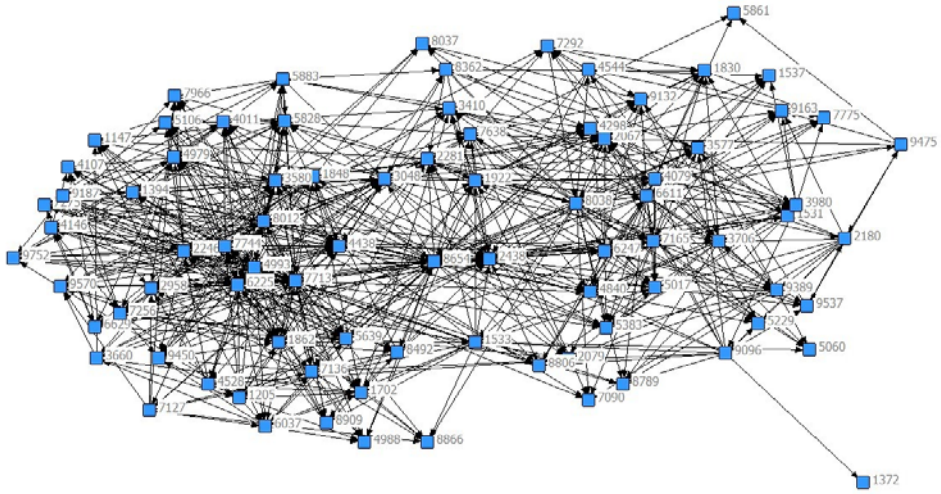

Figure 12. Positive Energy of Division 5 at T2: Received Small Group Debrief Intervention

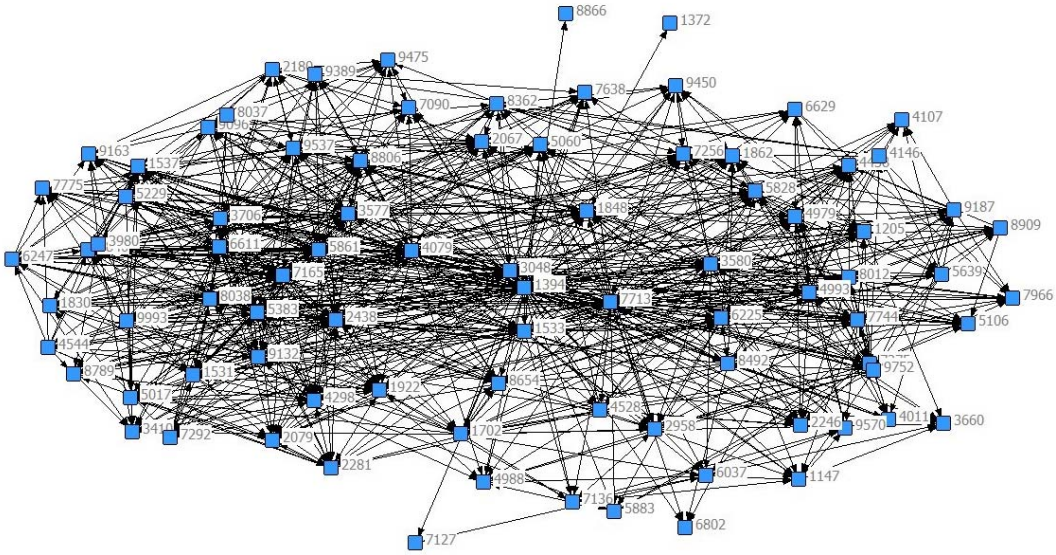

Figure 13. Positive Energy of Division 5 at T4: Received Small Group Debrief Intervention

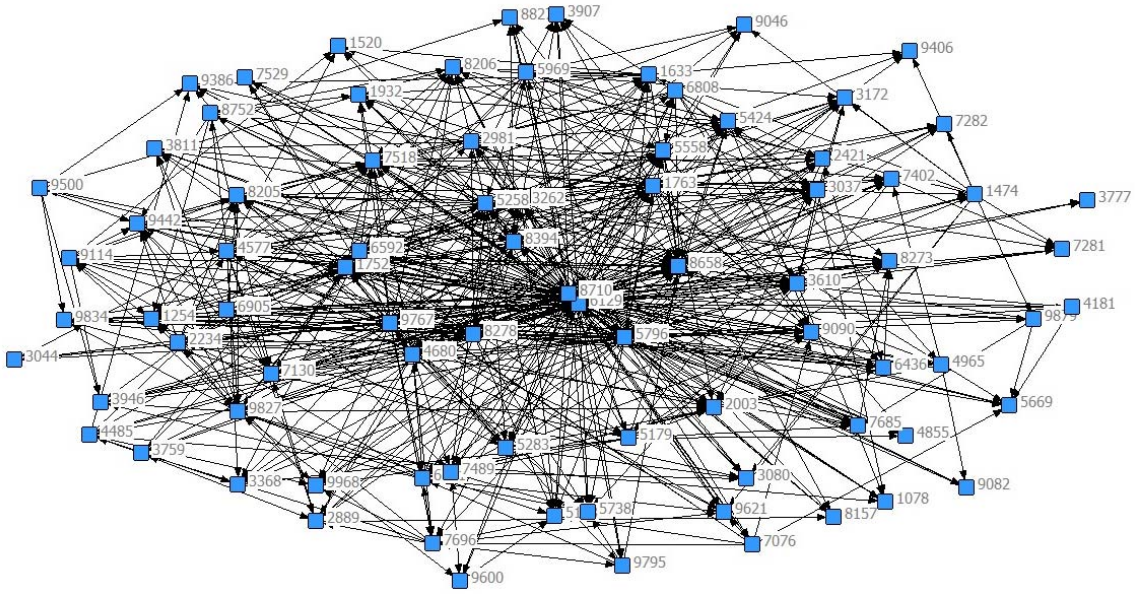

Figure 14. Positive Energy of Division 6 at T2: Received Small Group Debrief Intervention

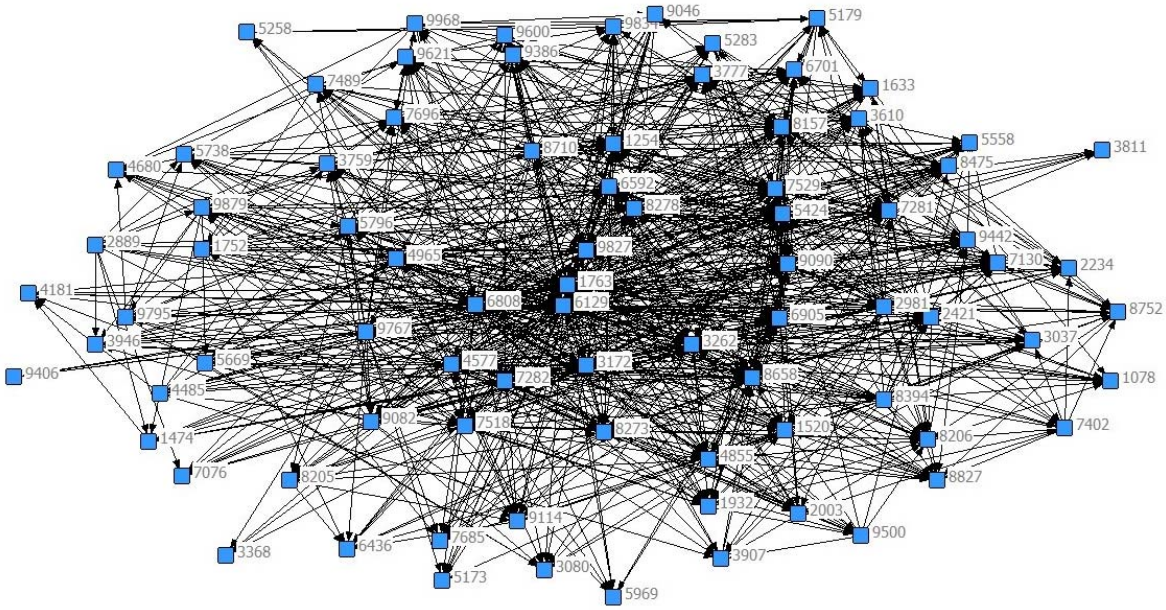

Figure 15. Positive Energy of Division 6 at T4: Received Small Group Debrief Intervention

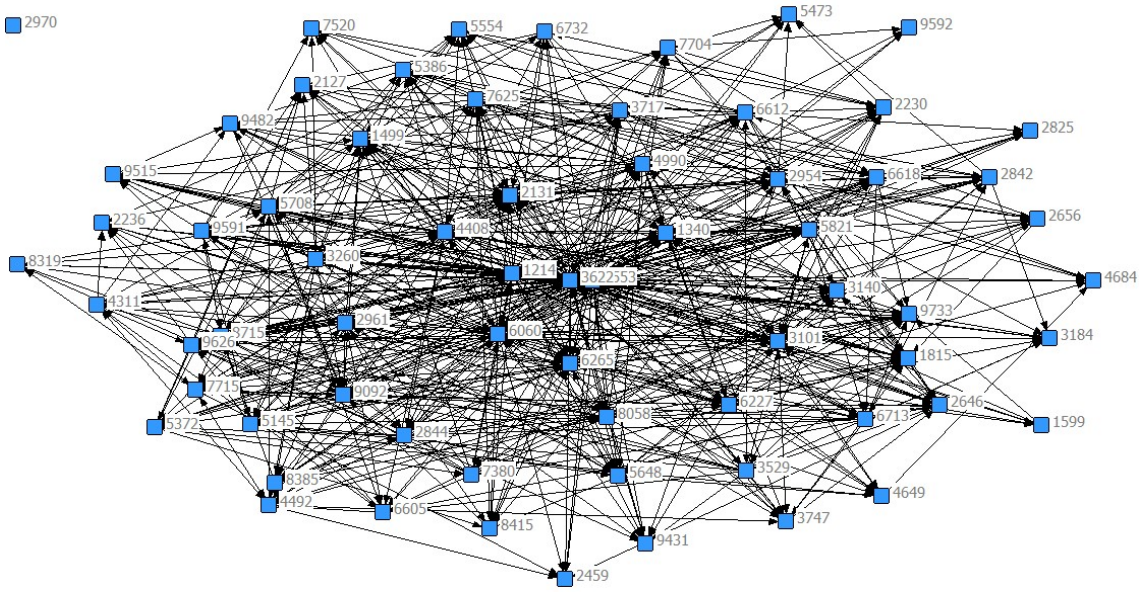

Figure 16. Positive Energy of Division 7 at T2: Received Appreciative Guided Conversation Intervention

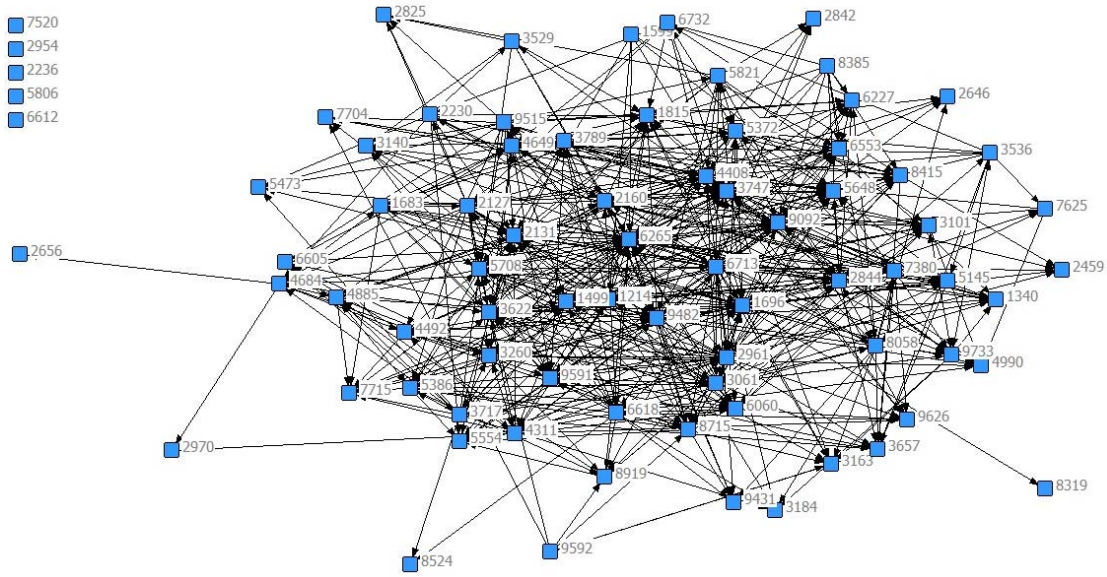

Figure 17. Positive Energy of Division 7 at T4: Received Appreciative Guided Conversation Intervention

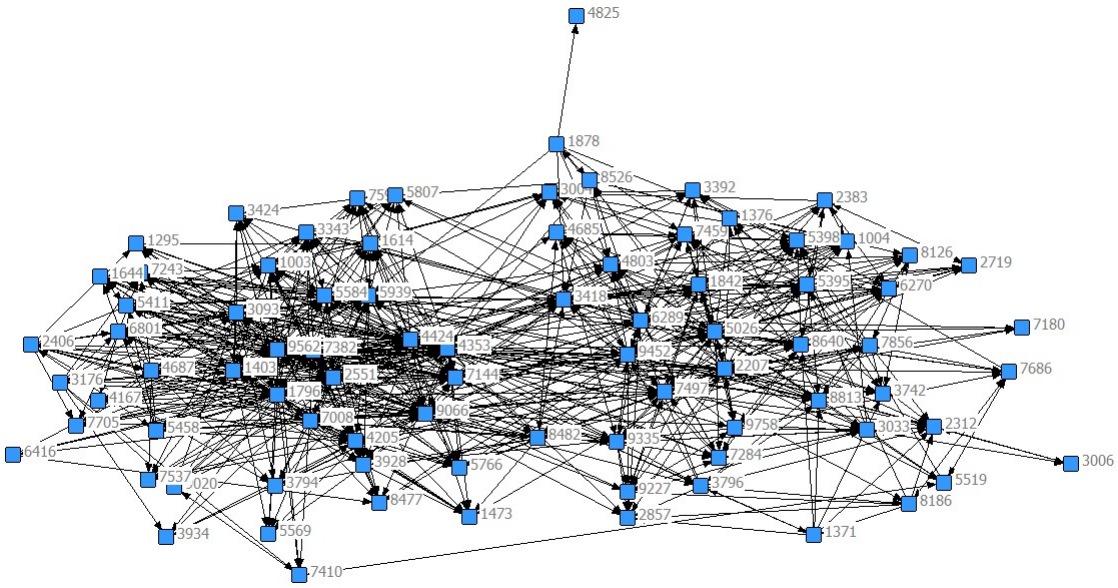

Figure 18. Positive Energy of Division 8 at T2: Received Appreciative Guided Conversation Intervention

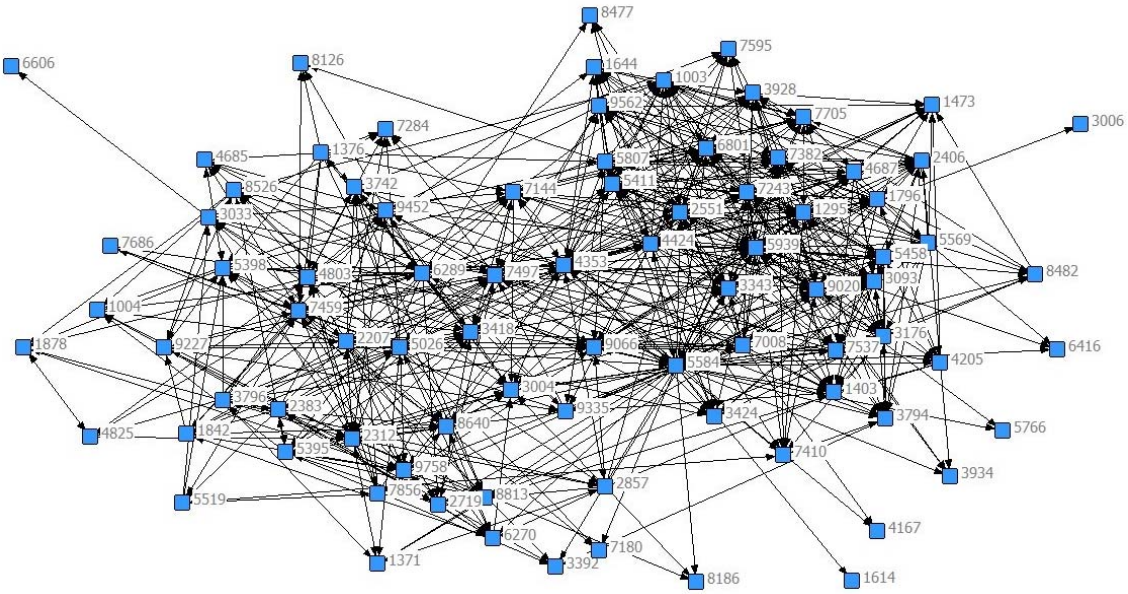

Figure 19. Positive Energy of Division 8 at T4: Received Appreciative Guided Conversation Intervention

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